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THE INTERNATIONAL ELECTROTECHNICAL CONGRESS OF TURIN.

It is interesting and important to notice that the Turin Congress, which has just passed, has left a noteworthy historical position for its proceedings by establishing an effective plan for the convocation of similar congresses in the future. Hitherto such electrotechnical congresses have come into existence under the stimulus and opportunity of some international exhibition. Thus, each of the large world's fairs of the past twenty years has given rise to an electrical congress. In general, such an arrangement is most suitable, but there is always a tendency for electrical congresses to form in too rapid a sequence, and no machinery has been in existence for regulating their successive reappearances. Now, by the action of the Turin Congress, this important question has been relegated to the jurisdiction of the International Electrotechnical Commission, which, being a permanent international organization, enrolling nearly thirty different countries and all the important electrotechnical societies of the world, is especially qualified to decide where and when such congresses should be held, and so to arrange for their organization that they shall aid and foster the international work of the commission itself. In conformity with this excellent arrangement, the American Institute of Electrical Engineers has already invited the commission, through President Dunn, to authorize and support an International Electrotechnical Congress at San Francisco, in 1915, in conjunction with the Panama opening festivities and the San Francisco World's Fair. This invitation has been cordially accepted by the I. E. C., so that the road lies invitingly before the American committee of that body to organize and prepare for the San Francisco Congress.

The proceedings of the Turin Congress presented several noteworthy features from the technical point of view. In the first place, it is to be noted that the Turin organization committee bespoke in advance about thirty written "reports" upon specified topics of a highly practical nature, with the view to presenting, from the pens of various specialists in different countries, a summarized statement of the industrial status in these respective topics. This plan has certain advantages and certain disadvantages. The salient advantage is that the transactions of the Congress, when finally published, become historically valuable, as crystallizing the electrotechnical status in each industrial department at the date of the convention. The principal disadvantages are that the Congress is forced, from the start, into a stereotyped literary form, viewpoint and mode of thought. Moreover, although some of the reports thus invited have been most fortunate and excellent in quality, others have been somewhat bare and barren compilations, as though the authors selected had responded in a blind alley of thought. Had the communications presented to the

Congress been confined to the thirty-one set themes propounded by the organization committee, it is likely that the proceedings would have lacked spontaneity and partaken too much of categorical prescription. Fortunately, however, the committee invited the tender of papers at large outside of the list of rigidly practical topics, and forty-nine such papers were accepted and read, thus giving to the proceedings as a whole, not only a suitable dash of wholesome theory, to balance the set dishes of industrial practice, but also that indescribably valuable tinge of spontaneous variety which so characterizes the fields of modern applied science.

In view of the experience acquired in this valuable experiment of the Turin Congress, it is a question worth debating whether, in preparing for future congresses, their organizing committees might not advantageously restrict the number of set titles given out in advance to, say, a dozen, and make up the rest of the intellectual menu by inviting men well versed in as many directions of electrotechnics as possible to provide communications on topics of their own selection, with a view to securing not only a wide variety of topics, both theoretical and practical, but also a wide range of natural selection. It may be added that for the St. Louis Congress a plan somewhat along these lines was followed. A tentative list of authors and subjects was submitted to the chairman of each section for approval and revision, after which the invitations to authors were issued by the general secretary. The subjects were chosen to accord with the special knowledge of the one invited to contribute, who, however, was not limited to the precise topic suggested, and the form of papers was not specifically indicated. Whatever opinions may be held upon the Turin program, there can be no doubt that the plans of the organizing committee for carrying on and systematizing the work of the Congress in its various sections were excellently carried out, a boon for which the administrative staff, and particularly the secretaries, are to be held in praise.

Among the technical resolutions of the Congress, that on the unit of train acceleration in industrial traction is noteworthy, namely, the mile (or kilometer or verst) per hour per second. This unit, long championed by Mr. C. O. Mailloux, is amply capable of justifying itself from a practical standpoint, and is not likely to be superseded. From a strictly scientific point of view, this unit is not thoroughbred. It is a hybrid, involving two different units of time—the hour and the second. Theoretically, the meter per second per second would be a better fundamental unit, but practically such a unit would have no chance of being adopted. The difficulty in its path arises from our sexagesimal time, which is a miserable conglomeration, from the arithmetical standpoint, of 24 hours of 60 minutes of 60 seconds. Ten hours of 100 minutes of 100 seconds would have been far more easy to manipulate numerically, but no change in this ancient order of the day is likely to be inaugurated for generations to come, so that we must content our souls in patience with the continual differentiation between meters per day, meters per hour and meters per second. The human mind passes from the concept of dollars to cents by a path so easy as the shifting of a decimal point in thought, but what intelligence is there among mortals that can jump in sixties with as little effort?

TEMPERATURE FLUCTUATIONS IN LAMP FILAMENTS.

Experimental observations indicate that the energy radiated from a body at one temperature to a body at a lower temperature varies directly as the difference between the fourth powers of the two temperatures measured from absolute zero. Throughout a limited range of temperature difference the transfer of energy is approximately proportional to the difference in temperature, so that the formulas for expressing the rate of cooling of a body from a moderate temperature elevation above its surroundings can safely be based on the assumption of a logarithmic decrement with respect to time. This assumption is usually made when dealing with the ventilation of dynamo-electric machinery and transformers. Some very simple equations for representing the fluctuations in the temperature of incandescent-lamp filaments can be derived on the basis of this assumption, but the results obtained from such equations must be quantitatively much modified to correspond with the facts on account of the relatively large difference in temperature between the lamp filament and its surroundings. However, qualitatively considered, the results are of considerable interest. In a recent issue of *Elektrotechnik und Maschinenbau* there appeared an article by Mr. Fritz Kesselring showing comparative results calculated for four different incandescent lamps. For the purpose intended the comparisons are instructive, although the results should not be accepted as quantitatively correct without experimental verification.

A REALLY HIGH VOLTAGE SYSTEM.

Even in these days a working voltage of 100,000 is sufficient to mark an energy-transmission plant as decidedly out of the ordinary. The experiences acquired at such extreme pressure are somewhat different from those familiar to the ordinary high-tension operator, and when one couples with this extreme voltage the difficulties which are encountered in operating transmission lines over the mountains at high altitudes and under ferocious stress of weather a condition is reached in which continuous operation is an engineering feat of no small importance. Such, however, is the situation in which the Central Colorado Power Company, which has frequently been referred to in these columns, finds itself, and the account of its high-tension line work elsewhere in this issue is of value to the engineering profession. The system, as our readers already know, is a very extensive one with two great generating stations at Shoshone and Boulder, each of approximately 10,000 kw, and connections with several other plants of small size which can be used in time of emergency. The main transmission is at 100,000 volts at the power houses, over nearly 200 miles of high-tension system, the longest main transmission being from Shoshone to Denver, 153½ miles. The line crosses the continental divide at three points, varying in height from 12,000 ft. to 13,700 ft. above the sea, and the weather conditions are, from all accounts, the most serious which are to be met by any high-tension system in

this country, or probably in the world. In view of this fact the line structure is of particular interest. The standard support is a latticed steel tower rising 44 ft. above the ground on which the wires are supported by suspension insulators. The line wire is in the main No. 0 equivalent, six-stranded cable, laid over a hemp core. The spacing between wires is 10 ft. 4 in. and the middle point of the spans has a minimum clearance of 22 ft. The average span length is about 730 ft. It will be noted that the towers are not of extreme height, but that the liberal sag allowed permits of long spans, which are advantageous in minimizing the number of insulating supports. This line is one of the few in the country where the wind really rises to dangerous velocities, and some trouble has been experienced with swaying of the wires, producing short-circuits. In fact, at certain points where trouble has been extreme it has been found necessary to dead-end the line at each tower and then to guy the towers so that the conductors could be pulled up tauter than in the normal span and so relieved of the danger. At the worst spots the long spans themselves have been anchored by messenger cables stretched across the line and holding it in place by suspension insulators, the cables themselves being anchored into rock.

As regards the general operation of the line, it is noticeable that high-tension switches are used in small numbers and with great caution. There are no automatic high-tension switches at all, and those which are manually controlled are only at the substations and the generating plants; moreover, the high-tension circuit is not opened while alive unless in extreme emergencies. In such lines the fewer switches the less temptation to play with them, and there is something to be said even for abandoning high-tension switching altogether. Thanks to good construction and effective insulators the system despite its high voltage seems to have had no more troubles than fall to the lot of many another operating at half the pressure. Lightning protection is carried out by the use of ground wires on part of the system and the installation at stations of electrolytic lightning arresters. These precautions seem to have been reasonably effective, for last July, in spite of lightning storms on fourteen days, there were but four cases of trouble on the high-tension lines. On a long high-voltage system like this the capacity of the line and the leakage and coronal losses are phenomena seriously to be reckoned with. The losses at no-load may and do rise to hundreds of kilowatts and the charging current is of a formidable size. Inductive load becomes a blessing, and in point of fact this long transmission line is worked very near to unity power-factor, with an average load-factor of 50 per cent. Aside from the matters pertaining strictly to the line, perhaps the most striking feature of the situation is the ingenious connection to the plant of the Denver Gas & Electric Light Company, one of the largest consumers on the system. The steam plant of this company is kept ready for operation in case of emergency and actually is operated regularly for part of the night load. A large bank of boilers is equipped with oil-burning apparatus, the particular fuel employed being water-gas tar from the gas department, kept in storage tanks and fed by a pipe line to the boiler-rooms under pressure. The pipe line has a core consisting of a ½-in. steam pipe through which live steam is passed in cold weather to prevent the oil from thickening. In case of need the whole bank of six boilers, kept hot by banked coal fires, can be given full heat from the oil burners in three minutes from a call to arms. Practice drills are suddenly sprung upon the operating staff once a week to keep them ready for action and the temporary interruption can thus be met without any material disturbance of service. The result of these precautions is very salutary, for while interruptions of service are actually few, the fear of them is put aside by the promptness with which the steam auxiliaries can be put into service.

DIRECT AND INDIRECT LIGHTING.

One of the very interesting papers at the convention of the Illuminating Engineering Society was that by Mr. J. R. Cravath on "The Effectiveness of Light as Influenced by Systems and Surroundings." This was in fact a comparison of the light required for reading ordinary print when that light was supplied by direct and indirect systems of illumination. It covered somewhat the same ground as a paper on a similar topic by Mr. Millar at the Boston convention of 1907, but the conclusions reached were radically different, and different, too, in ways so singular as to call for further investigation. Each series of experiments was carried out in somewhat similar fashion. A room of moderate dimensions was chosen and equipped both for direct and indirect illumination. Then a number of persons, supposedly without any interest in the results, were selected and individually required to determine the amount of light for comfortable reading. The illumination was then measured at the location of the paper read. In the experiments by Mr. Millar the observers were allowed to locate themselves wherever they saw fit in the room and read with the paper at the most comfortable angle. In Mr. Cravath's experiments each of the readers was placed in the same fixed position with the paper horizontal on the desk at which the reader sat. The chief further difference was that in Mr. Millar's test room the ceiling was a light buff in color and the walls white, while Mr. Cravath used ceiling and walls of smooth plaster very light cream in color, the room being considerably larger and somewhat lower than that employed in the earlier experiments.

The net result in Mr. Millar's experiments was 2.7 ft.-candles of direct illumination and 4.45 of indirect for comfortable reading. The smallest amount required by any one of the observers was 1.85 of direct illumination and 2.7 of indirect. In Mr. Cravath's experiments two illumination values were determined by each observer, one the minimum comfortable for steady reading and the second corresponding to the illumination considered ample for regular work. The latter condition corresponds practically to that in Mr. Millar's experiments with the difference that the test-type used by Mr. Cravath was undoubtedly more easily read than that used by Mr. Millar. Comparing two distributions of indirect and of direct lighting, the average in ft.-candles required in the later experiments was 1.21 for indirect lighting and 1.34 for direct, the difference being, therefore, entirely

negligible, particularly in view of the very great differences between the results of individual observers in Mr. Cravath's tests, which differences were comparatively small in the earlier tests by Mr. Millar. A very interesting addition in the later experiments was the trial of direct illumination from an opaque shade hung just above the paper to be read, leaving the remainder of the room entirely dark. In this case the average estimate for ample reading light was 3.45 ft.-candles, more than two and one-half times the figure necessary with the ordinary direct or indirect systems.

In the analysis of these results Mr. Cravath judged the abnormal amount of light necessary for convenient reading in Mr. Millar's experiments to be due to the glare on the paper and in the eyes produced by the somewhat brilliantly illuminated walls, much more of the light in these experiments having reached the side walls directly than in his own tests. Both on general principles and from the statements in the earlier paper this opinion seems correct. The mere fact that in Mr. Millar's experiments 4.45 ft.-candles were required for easy reading is sufficient evidence of some decidedly adverse conditions operating on the eye, since from numerous tests, from school-house illumination for instance, as well as in offices and counting-rooms, it is perfectly clear that if the eye is given fair play it will work easily and up to its full efficiency on very much less light than this. To Mr. Cravath's experiments, on the other hand, one must take exception because of the enormous variations found between different individuals, and particularly on account of the very low illumination with which some experimenters were able to read with the utmost comfort by both systems of illumination. These facts indicate very plainly the existence of extremely large physiological or psychological differences either inherent in the individuals or accidentally interpolated in the experiments. For instance, there is every physiological reason for doubting whether 0.4 of a ft.-candle is ample reading illumination, even under the most favorable circumstances, for regular work, and this figure was reached by three of Mr. Cravath's experimenters. On the other hand, when using the desk shade two of his observers required in excess of 10 ft.-candles for reading ordinary type, showing again the existence of abnormal factors influencing these results.

The same differences with the same observers held for the establishment of the minimum illumination comfortable for steady reading. In this case the differences are ascribed, and in part no doubt correctly, by Mr. Cravath to differences of glare, which to a certain extent affects all brightly lighted surfaces. It seems likely, however, that the fixed position of the paper and the requirements that it should be read in a horizontal position may have influenced these results more than any of the external conditions of illumination. A mere difference in the height, sitting, of the various subjects and in the normal reading distance of their particular eyes would sufficiently influence the angle at which the type was read to change the conditions of glare in a very radical manner. Besides this, the data given for the various tests indicate pretty plainly very large psychological differences in what the subjects considered sufficient lighting, differences possibly complicated by uncorrected errors of vision. The less height and greater distance of the walls in Mr. Cravath's experiments undoubtedly reduced the general glare into the eye which, it seems likely, was responsible for the large figure in the previous investigation. It is interesting to observe that in the average the later results show that 1¼ ft.-candles to 1⅓ ft.-candles gives comfortable reading conditions where there is reasonable freedom from glare, an amount corresponding very well with the data of physiological optics. To sum up the results of these very useful investigations, they seem to show that efficiency in illumination by either system depends on the avoidance of specular reflection from paper and of strong extraneous light entering the eye from useless or unusual directions. With these conditions fulfilled there should be no material difference in ft.-candles required under any particular system of illumination, and Mr. Cravath's results, in which differences between individuals are enormously greater than those between systems, seem most effectively to enforce this conclusion.

THE MODE OF CONDUCTION IN GASES ILLUSTRATED BY THE BEHAVIOR OF ELECTRIC VACUUM VALVES.

An interesting paper appears in the July number of the *Philosophical Magazine,* by Dr. Oliver Lodge, and is couched in the characteristic literary style of that versatile writer. The paper relates to a particular type of electric valve. An electric valve may be defined as a conductor which permits electricity to pass through it more easily in one direction than in the other. At least three different types of electric valve are known, namely, (1) crystal rectifiers—so called—as used in wireless signaling; (2) electrolytic rectifiers, and (3) low-pressure gas tubes of the mercury-arc type. Dr. Lodge's paper describes a new form of valve of the third or low-pressure gas type, and, curiously enough, the particular form he illustrates and describes is provided with a stop-cock mechanical valve of glass. His clear and simple method of describing the experiments made with this apparatus illuminates magically the whole process of electric conduction in solids and liquids, as well as in gases.

The idea suggested is that when a low-pressure gas-conducting tube is subjected to a difference of electric potential the neutral gas-atoms are ionized at the anode, or positive electrode; negative electrons enter the electrode from the atoms, which, then, being relatively bulky bodies, move along at a leisurely gait of some kilometers per second toward the opposite electrode. As they are in no great hurry, they make no objections to going around corners or taking long paths. When they arrive at and near the cathode, or negative electrode, they help to produce a very powerful local gradient of potential at its surface. As soon as this potential gradient becomes steep enough, and a certain critical value has to be exceeded, negative electrons are displaced from the cathode. Being extraordinarily small bodies—by belief 1/1700th of the mass of a hydrogen atom—these negative electrons are shot off from the cathode at a huge velocity, approximating that of light in air; but the total quantity of electricity they carry collectively is surprisingly small considering how much fuss they make and how much energy they contain at this velocity. The cathode stream of negative electrons.

projected with high velocity, fly in bee lines perpendicularly away from the surface at which they are generated. The refuse to go in curves or to take devious paths, unless acted upon by electromagnetic forces.

According to the paper, when fast-flying minute negative electrons hit the leisurely and oppositely moving positive atoms, there may be occasional unions and neutralizations; but, as a rule, the collision does not result in a combination or neutralization. Nevertheless, a stream of positive atoms can be checked and arrested by the impact of negative electron fire. When in a relatively narrow alley, such as a long, straight tube, the negative projectiles are fired in the face of positive atoms, the advance of the latter is stopped and the electric flow is mainly stopped; that is, the tube has high resistance. But if a by-pass can be opened through a side door of the vacuum tube, through which the positive atoms can get around and reach the flank of the cathode without encountering the rapid fire of the cathode-stream maxims, the resistance of the tube will fall at once and the positive atoms can, in a certain sense, be seen to move along the by-pass and carry the current. The paper points out that within the substance of metals the minute negative corpuscles carry the electric current. In liquids and electrolytics both atoms shorn of electrons—that is, positive electrons as well as corpuscles or negative electrons—carry current, whereas in gases it is mainly the positives that do the conducting.

THE ILLUMINATING ENGINEERING SOCIETY CONVENTION.

At the recent convention of the Illuminating Engineering Society in Chicago one of the things not down on the program which came in for a share of discussion was the degree of success attained by the society in the broad field which it started out to cover by soliciting the co-operation of those directly engaged not only in illumination designs and installations but also in many other closely allied lines. Some criticisms have been made of the society "from within" recently to the effect that architects have not been induced to take as active a part in its affairs as had been hoped. Another criticism is to the effect that the *Transactions* of the society do not contain sufficient "ready to apply" information put up in neat packages ready to distribute to salesmen and non-technical men generally. Both of these criticisms seem to have been well answered. As to the architects, it is well known that it has been the constant effort of the society and its members to engage their interest, and while it is true that the membership roll includes a comparatively small number of architects, it is also true that there is an increasing respect for the work done by the organization among architects and that they are looking more and more to members of the organization for advice. It is hardly to be expected that architects will take active part in all the organizations of the numerous branches of engineering which go into the construction of modern buildings. There is still much to be done in the way of drawing the attention of architects to the necessity for studying illumination plans, but conditions are far better than they were five years ago. As to the criticism that the information obtainable from the *Transactions* is not of sufficiently popular character, it would seem that such reflections are really a tacit admission on the part of the critic that he is unable or unwilling to translate into practical and popular language the many useful and instructive things which appear in that publication.

A significant indication of the progress in illuminating appliances during the last five years was the session devoted to illuminating glassware. While this session was not particularly productive of fresh information on the subject, the very fact that enough new kinds of glassware have been brought out during the past five years to make possible several papers dealing with different varieties indicates the progress that has been made. Two papers took up questions relating to the methods of rating the commercial performance of illuminants. One of these suggested a new method of rating the useful life of incandescent lamps and the other called attention to the many diverse factors which enter into the total cost and useful performance of any artificial illuminants. It is well that we revise our ideas from time to time on these subjects, as some elements formerly not considered are found to enter into costs and life values. Perhaps the two most general tendencies noticeable in the papers and discussions were an increasing interest in daylight and an increasing emphasis on the importance of diffusion and of general as against localized and unidirectional illumination. Since daylight is recognized as having many qualities which are frequently lacking in artificial lighting as at present carried out, a scientific study of the exact characteristics of daylight which give it its superior qualities is desirable. The beginning of such a study and the announcement of some of the results was the subject of one paper.

On the subject of providing more general and diffuse illumination in ordinary practice two speakers called attention to the increasing tendency to provide more general illumination and do away with methods of lighting by individual lamps close to the work alone. The longest discussion of the convention took place over a paper in which the questions of diffused versus direct light for desk work and reading were involved. While the tests reported in the paper were inconclusive on many of the finer points, they indicated decisively the importance of giving more attention to the quality or diffusion of light on the work than has frequently been done in the past. Incidentally, the discussion of this paper naturally drifted into a controversy over the merits of direct and indirect lighting methods, and the interest excited fully demonstrated the truth of an editorial statement in these columns recently that it is necessary merely to bring up the question of direct versus indirect lighting to arouse a lively discussion at any gathering of illuminating engineers. One of the points brought out in tnis paper and discussion is that the factor of glare from paper under some conditions is so obtrusive and annoying that one can afford to go to much pains to get rid of it by proper diffusion. It is quite possible that in the near future specifications for satisfactory illumination will not only call for a certain value in illumination as measured on a horizontal plane, but will also include the illumination as measured in three or four inclined or vertical planes intersecting the same point, in order to determine whether the preponderance of illumination from one direction is so great that it is likely to cause trouble by glare from the work.

Convention of American Electric Railway Association.

The thirtieth annual convention of the American Electric Railway Association will be held at Atlantic City, N. J., on Oct. 10-13. Meetings will be held by the parent association and the affiliated Accountants', Engineering, Claim Agents' and Transportation & Traffic associations. Forty-six committees of the various associations have considered subjects relating to electric railways during the year and will present formal reports at the meetings. The sessions of the Engineering Association will start on Oct. 10 and meetings will be held each day until Oct. 13, when the concluding session will take place.

The committee reports to be received by this association will be on the following subjects: Education of engineering apprentices, power distribution, heavy electric traction, block signals for electric railways, engineering accounting, power generation, buildings and structures, way matters, equipment, rules of procedure for the committee of standards, and standards. Two of the reports in the foregoing list will be considered jointly with other associations.

It is expected that the attendance will be the largest that the association or its predecessors have had in any year. A large exhibit will be made by manufacturers on Young's Million-Dollar Pier.

An Anglo-American Electrical Gathering.

A notable gathering of electrical men attended a dinner given by Mr. Samuel Insull, of Chicago, at Delmonico's uptown restaurant in New York on the evening of Sept. 28, with Mr. S. Z. de Ferranti, president of the (British) Institution of Electrical Engineers, as the guest of honor. Other English guests were Mr. Charles H. Merz, consulting engineer, of London and Newcastle; Mr. Arthur Wright, of London, inventor of the Wright demand meter; Mr. J. R. Raven, mechanical engineer of the North Eastern Railway, of England; Mr. R. Thompson, assistant mechanical engineer, North Eastern Railway, and Mr. H. A. Couves, of Newcastle, assistant to Mr. Merz. To meet these visitors Mr. Insull invited a number of American electrical men. In all there were forty-seven gentlemen present. Mr. Thomas A. Edison, who would no doubt have honored the occasion with his presence if he had been in this country, is in Europe, and Mr. C. A. Coffin, president of the General Electric Company, arrived from a trip abroad on the very day the dinner was given and too late to attend.

Mr. de Ferranti was seated at Mr. Insull's right and Mr. Merz was at Mr. Insull's left. In an introductory speech Mr. Insull, himself an Englishman by birth, said that it gave him great pleasure to be the means of bringing together some distinguished countrymen of his and some of the leading electrical men of the United States. In speaking of Mr. de Ferranti Mr. Insull gave that gentleman credit for being the first man to mass the production of electricity, generating energy at high potential at a place where it could be produced cheaply and transmitting it to the area of supply. Mr. Wright was referred to by Mr. Insull as the "man who taught us how to sell electricity," for the Wright demand system is the basis of practically all methods of charging for electrical energy at the present day. Mr. Merz was spoken of as a man who has done wonders in the wholesaling of electrical energy, referring, of course, to the notable achievement in the Newcastle area in England.

In responding Mr. de Ferranti spoke on the subject of possible future reductions in the cost of producing electrical energy. The speaker predicted that in the future electricity would be the agent used for supplying energy needed for all purposes. Mr. Vanderlip, president of the National City Bank of New York, spoke on the financial aspects of the electrical industry, and Dr. Steinmetz paid a glowing tribute to the early work of Mr. de Ferranti in the generation of alternating current at high potentials and its transmission and distribution.

The dinner was held in the large banqueting hall at Delmonico's and was elegant in all of its appointments. The table was arranged in the shape of an ellipse and the center was a great mass of flowers and ferns. The wall decorations included American and British flags, and during the dinner there was instrumental music. A reception preceded the dinner, and at its close the gentlemen present extended their best wishes to the departing Englishmen, who sailed on the *Mauretania* this week.

Among the guests were officers of the leading electrical corporations of the country, financial, manufacturing and operating, and representatives of the engineering profession, including Messrs. F. B. Sprague, C. P. Steinmetz, F. Sargent, C. G. Curtis, H. G. Stott, W. L. R. Emmet, J. W. Howell, M. I. Pupin, C. F. Scott, D. C. Jackson and F. B. Crocker. The electrical press was represented by Messrs. James H. McGraw and Charles W. Price.

Milwaukee Company Section of N. E. L. A.

A successful meeting of the newly organized company section of the National Electric Light Association in Milwaukee—the Milwaukee Electric Railway & Light Company Section—was held in the Public Service Building on the evening of Sept. 26. The attendance was 115, and Mr. O. M. Rau, the president, was in the chair. The other officers are: Vice-president, Mr. George G. Post; secretary, Mr. F. A. Boehm; directors, Messrs. C. N. Duffy, James D. Mortimer, E. Douglas and R. H. Pinkley. Mr. Rau, the first president of the section, delivered an inaugural address, in which he pointed out the advantages of organized co-operation among the employees of the company. He made a plea for good fellowship, so that all employees will be not only co-workers, but friends. Furthermore, every member, as a result of the meetings, should have a general knowledge of the work done in every department of the company. A "question box" and a "suggestion box" were advocated, as well as a strong effort to bring about social and entertainment features.

Mr. T. C. Martin, secretary of the N. E. L. A., was present and he felicitated the section on its promising beginning. He told of his Pacific Coast trip and of having addressed the British Columbia section in Vancouver and of assisting in organizing sections in Portland (Ore.), Seattle, Spokane and a Twin City section in Minneapolis and St. Paul. He attended the convention of the Northwest Electric Light & Power Association, which voted to affiliate with the National Electric Light Association, which has now more than 10,000 members and is the largest engineering or semi-engineering society in the Western Hemisphere. The work of the N. E. L. A. is largely educational in character and the advancement of the section idea is perhaps the most important feature of that work. Usually each central station stands alone in its own community. To get new ideas men must go outside their own districts. For this purpose the N. E. L. A., with its various sections and committees, is almost indispensable. A man must grow if he is to stay in the business and his company section affords him a valuable opportunity. Mr. Martin concluded by extending the greetings of President John F. Gilchrist, of the national association.

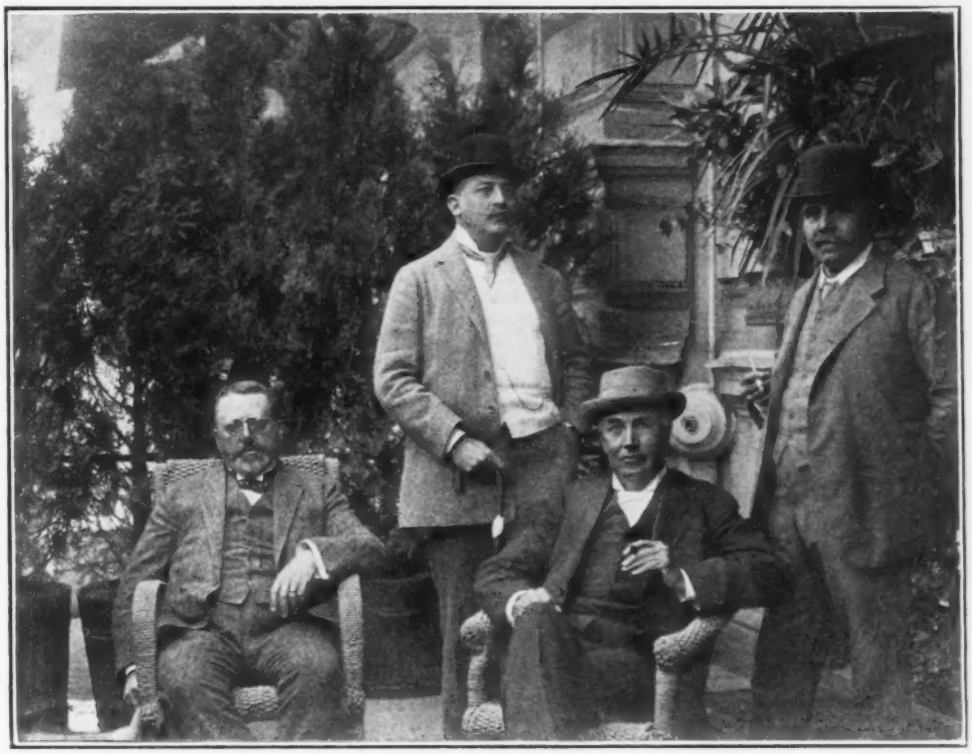
Mr. Rau then called on Mr. Post to read a communication from Mr. J. D. Mortimer, the vice-president of the Milwaukee Electric Railway & Light Company, who expressed in sympathetic language the sincere interest of the company in the formation of the section as a measure tending to advance the mutual interests of employer and employee. The technical program of the evening consisted of the reading of a valuable paper by Messrs. O. M. Rau and G. G.

Post on "Our Electric System." The paper was illustrated by lantern slides and was an excellent condensed description of the electrical generation, transmission and distribution of the Milwaukee Electric Railway & Light Company.

Edison in Hungary and Moravia.

Mr. Etienne de Fodor, general manager of the Budapest General Electric Company, entertained as guests Mr. and Mrs. Thomas A. Edison and party during their sojourn in Hungary and Moravia. Mr. Edison's party included his children, Madeline, Charles and Theodore Edison, and Major and Mrs. Oeser. Mrs. Oeser is a daughter of Mr. Edison by his first wife, her husband being an officer in the German army. Mr. Valentine, a special correspondent of the New York *World*, also accompanied the party.

Mr. de Fodor met the Edison party in Vienna on Sept. 9 and 10, and while there induced Mr. Edison to change his route and take a look at the Hungarian capital, where the guests arrived on Monday, Sept. 11. They were received at the railroad station by Mr. Francis Jehl, an old Menlo Park assistant of Mr. Edison, and many representatives of the press. The party were then conducted in Mr. de Fodor's automobiles to the Grand Hotel Hungaria, where a large crowd had already gathered who heartily cheered Mr. Edison. They were then escorted by Mr. de Fodor to the "state rooms," usually used only by royalty and persons of distinction, which he had reserved and placed at their disposal.



Mr. Etienne de Fodor. Mr. Alexander von Stromszky. Mr. Thomas A. Edison. Mr. Francis Jehl.

Mr. Edison in Hungary.

Later in the day Messrs. de Fodor and Jehl conducted the party in automobiles around the city, showing them everything of special importance, including the royal palace, which interested Mrs. Edison very much, while Mr. Edison calculated the interest on the money invested and lost every year in keeping it up. Returning to the hotel about 7 o'clock, the party took a stroll on the "Corso" by the Danube, from which the beautiful position of Budapest can be best appreciated. Suddenly Mr. Edison was recognized by some one, and shortly a crowd accumulated that completely blockaded the promenade. Numerous reporters asked for an interview, with which request he complied upon condition that they would come with him to the hotel.

About 8:30 the guests were conducted by Mr. de Fodor into the "grand salle" to a banquet in their honor. The company was a brilliant gathering of Hungary's distinguished men, among whom were Count Khuen-Héderváry, the present minister-president of Hungary; Koloman von Szell, former minister-president; Frank von Kossuth, the son of the great Kossuth; former minister Count Albert Apponyi and wife; Albert von Berzeviczy, the president of the Parliament; Professors Carl Zipernowszky, Söpkesz, and Ilosvay, Privy Councilors Alexander von Stromszky and Michael Kajlinger; Mr. Nash, the United States Consul-General; Mr. and Mrs. Mead, of Boston, and leading Hungarian editors. The banquet lasted nearly to midnight, and as the party started to leave the band struck up "The Star-Spangled Banner."

On the morning of Sept. 12 the Edison party made preparations for departure for Pressburg, leaving Budapest about 10:30. The streets before the hotel were so crowded that a large force of mounted police was on duty to keep order, and reporters and cameras abounded. When Mr. and Mrs. Edison appeared at the entrance of the hotel to step into their Daimler car, which had come up during the night from Vienna, the crowd cheered with such enthusiasm that the applause was heard on the other side of the Danube and it was remarked by many that such a reception had not been given to a foreigner for years. Messrs. de Fodor and Jehl took seats in the Edison automobile, while the rest of the party, including Major and Mrs. Oeser, Messrs. von Stromszky and Valentine, went into a Protos car that was placed at the disposal of the Edison party as long as they were in Hungary and Moravia by Mr. A. von Stromszky, the general manager of the Siemens-Schuckert Works. All along the route people cheered Edison as he passed. Unfortunately when automobiles reached the other side of the Danube embankment, opposite the Hungarian Parliament Buildings, the Edison car showed a defect in its differential gearing and could not be restarted. Mr. de Fodor then transferred Mr. and Mrs. Edison, Madeline and Theodore Edison into the Protos automobile and started on the journey for Pressburg across the Hungarian plains, while Major Oeser and Messrs. von Stromszky, Valentine and Jehl remained behind to take the afternoon train for Pressburg, in the meanwhile making arrangements to have the Edison car repaired in Budapest. A Daimler car was found at a garage, its differential taken out and mounted in the Edison machine, so that by 8 o'clock in the evening the Edison automobile, with an engineer of the Budapest General Electric Company acting as pilot, started for Pressburg, where it arrived about 4 o'clock in the morning. Those who went to Pressburg by train reached that place just about an hour later than the Edison party.

Mr. Charles Edison left the party in Budapest in order to take the 3 o'clock train for Hamburg, from where he sailed on the steamship *Kaiserin Auguste Victoria* for New York, so as to be in time for the continuation of his studies in college, while Mr. and Mrs. Edison and the rest

of the family were to sail from Hamburg on Sept. 28 on the *Amerika*.

Pressburg, it may be mentioned, is Mr. de Fodor's native town, and as the telegraph had announced that he was coming on with Mr. Edison and party they received an enthusiastic welcome. At the Hotel Savoy, upon whose roof "Old Glory" was fluttering, Mr. de Fodor had engaged a suite of rooms which he put at the disposal of Mr. Edison and his party. After a short rest the guests were taken around the city and shown all places of interest, chief among which were the old castle and the building where Napoleon signed a treaty of peace. In the evening dinner was taken in the garden terrace of the Savoy Hotel, where Mr. de Fodor introduced Mr. Edison to all the dignitaries of the city and to many old friends.

In the morning on Sept. 13 the party left Pressburg amid the cheers of its citizens, who had flocked to see Mr. Edison, while Mr. Palugyai and some members of the local automobile club led the way with their cars. In Pressburg Mr. van Stromszky said good-by to Mr. and Mrs. Edison and the others and was thanked for his kindness in putting the Protos car at their disposal.

After the pilot friends had left, Mr. Edison's automobile containing his family and Mr. Jehl, took the lead and started on its journey through the remaining part of Hungary and then entered Austria and Moravia, being followed by Mr. de Fodor's car containing Major and Mrs. Oeser and Mr. Valentine, the representative of the New York *World*.

Lunch was taken at Nickolsburg, and Brünn was reached about 3 o'clock in the afternoon. As Mr. and Mrs. Edison were not tired, they proposed to tour the city first and then go to the hotel. Mr. Edison was impressed when he saw the theater, for it was the first theater in the world that was completely lighted by the Edison system and in which there never was a gas jet. The theater was built in 1881 and finished in 1882, the work of installing it with the Edison system being intrusted at the time to Messrs. Francis Jehl and Etienne de Fodor, who were Mr. Edison's pioneers in Europe.

Arriving at the Grand Hotel, where a large crowd was awaiting Mr. Edison and where he was cheered most cordially, the party was led to the suite of rooms that Mr. de Fodor had engaged for them some days before and which is reserved for persons of distinction. Mr. Edison then retired for a nap, while Mrs. Edison and the children with Mr. Jehl had tea. During this time Mr. de Fodor was busying himself with all the arrangements for the farewell dinner which was served about 8:30 in the evening in the large dining-room of the hotel. Several generals and other high officers, together with the Mayor and Vice-mayor of Brünn, were present, and all requested Mr. Edison for his signature.

In the morning about 8 o'clock the street before the hotel was beginning to get blocked with people, so that it was necessary to call for a squad of police to keep order. At about 9 o'clock Mr. Edison and his party descended and were met with a shower of flowers and stirring cheers—"Hoch! Hoch! Hoch!"—at which Mr. Edison bowed and saluted. Then the Edison family got into their car, while the Major and his wife took seats in an automobile that the New York *World* had placed at the disposal of its correspondent, Mr. Valentine, and which had come up from Vienna the previous day.

Mr. de Fodor and Mr. Jehl took the lead in the Protos car and escorted the party out of the city to the Iglau road that leads to Prague. Here a short halt was made, here the last handshakes were given and sincere wishes exchanged, and then with uncovered heads Messrs. de Fodor and Jehl watched the automobiles containing Mr. Edison and his party pass onward, standing still until they had disappeared in the distance, returning then to their motor and starting for Budapest.

Proposed Extension of Cleveland Municipal Lighting Plant.

The proposition to issue $2,000,000 bonds for the extension and improvement of the municipal lighting plant at Cleveland, Ohio, has been thrown into the political arena and is being buffeted about on all sides. Mr. Newton D. Baker, who has been spoken of as the natural and logical successor of the late Tom L. Johnson and who is the candidate for mayor on the Democratic ticket, has made the bond issue a plank in his platform. Director of Public Service Lea is in favor of a municipal plant, but opposes the bond issue. He desires that the plant be allowed to grow from its regular earnings and is, therefore, opposing Mr. Baker's arguments. He stated that he had asked Mr. Samuel Scovil, vice-president and general manager of the Cleveland Electric Illuminating Company, if he would consider the sale of the company's property to the city and received an affirmative reply. In reply, Mr. Baker asserted that a company paying 20 per cent dividends to its stockholders would not give up so easily as that and that he was not at all impressed with the statement. On a direct question from Mr. Baker, Mr. Lea said he was in favor of submitting to the people the question of buying the company's plant.

To support his contention Mr. Lea has prepared figures showing the income and expenses of the municipal plant in 1910, as follows: Total revenue, $93,962.52; total cost of maintenance, $64,370.81; adjustment of inventory, $435.37; insurance, $117.90; depreciation (7½ per cent on $305,150.66), $22,885; taxes (on 33⅓ per cent of valuation at 3.48 per cent), $3,539.74; interest on bonded debt of $30,000 at 5 per cent, $1,500. This brings the total up to $92,850.12 and leaves revenue over expenses of $1,112.40.

Deputy City Auditor Zimmerman estimates that the property is worth $310,905.86, as land does not depreciate in value. He says he would figure depreciation at 5 per cent on buildings and 10 per cent on the other parts of the plant. This, he says, would bring the total depreciation up to about $28,000. On the other hand he says the city receives only $10 per $1,000 taxes and that, therefore, the charge for taxes ought to be a little over $1,200 instead of $3,500.

Vice-President Scovil, of the Cleveland Electric Illuminating Company, asserts that the interest charge is insufficient to cover the actual cost. Interest, he says, should be charged against the entire investment of $360,000 in the plant. This figured at even 4 or 5 per cent would wipe out the profit of $1,112 on the business and leave something over, but the charge should be at the rate of 6 per cent, which would amount to over $21,000. He disagrees with Mr. Zimmerman on the matter of taxes, in that the plant has nothing to do with the distribution, but only on the amount that must be paid.

Mr. Scovil then pointed out that there had been no charge made for any part of the salaries paid to the employees of the offices of the city auditor, water works, purchasing agent and director of public service, in all of which work on the municipal lighting plant is being done. Mr. Zimmerman said he thought there should be an interest charge of 6 per cent on the investment of $310,000 and that the plant should stand some part of the salaries of those who have its business in charge.

The Electric Vehicle.

A meeting of the New England Section of the Electric Vehicle Association of America was held at the Edison Building, Boston, Friday evening, Sept. 22, at which Mr. Day Baker reported for the parking committee that the authorities had given their consent to vehicle owners to leave their cars on certain convenient streets in the city

for indefinite periods, which is a considerable extension of privileges hitherto accorded.

Mr. Stephen G. Thompson, of the Public Service Electric Company, of Newark, N. J., was the speaker of the evening. He said that his company had spent some $50,000 in its vehicle department and that it was prosecuting a campaign of publicity which promises large results. He predicted an annual demand of 300,000 electric vehicles for the near future and stated that orders taken thus far this year exceeded those of the whole of 1910. "Merchants are studying transportation costs as never before," he said, "and the problem is up to the users what means shall be employed." He recognized the fact that custom and a certain amount of prejudice have to be combated and urged that the best methods of sale be employed.

Mr. Thompson believed that the electric commercial vehicle has as its best field the work of department stores, where the package is the unit and the delivery is in urban and suburban limits. The economic zone of these electric vehicles is, he considers, to be in a radius of about 17 miles from the base of operation. Beyond this the local express companies can handle goods to better advantage, distributing them from various centers. In many cases one machine will replace two horse vehicles. A leading department store saved $16,500 on an operating cost of $48,000. In Boston, where about 25,000 tons of heavy freight are handled daily, a concern using electric trucks saved a sum on its own operation that would equal if applied to all trucking in the city a sum of over $1,250,000 annually.

A table showing a typical department-store route of 11.3 miles, with fifty stops, showed 96¾ minutes running time, while 87¼ minutes was required for the delivery of the packages at the houses. The average speed, including stops, was 3.7 miles per hour, and exclusive of stops 7 miles per hour, the route being through congested streets. The cost of operating 1-ton and 5-ton trucks, as reckoned from figures of averages taken in a large installation, gave the apportionment of costs of the various items as follows:

ANNUAL COST OF ELECTRIC VEHICLES.

	One-Ton.	Five-Ton.
Overhead:		
Interest	3.4 per cent	3.7 per cent
Depreciation	11.3 "	12.8 "
Insurance	4.3 "	3.3 "
Rent, etc	4.2 "	3.5 "
	23.2 per cent	23.3 per cent.
Maintenance:		
Tires	6.4 per cent	17.9 per cent
Batteries	10.8 "	14.0 "
Mechanical	8.5 "	7.6 "
Lubrication	0.2 "	0.2 "
	25.9 per cent	39.7 per cent
Labor	43.4 per cent	28.0 per cent
Energy for charging	7.5 "	9.0 "
	50.9 per cent	37.0 per cent

Mr. Thompson advocated co-operation between central-station managements and vehicle manufacturers and said that the attitude of the former should be unbiased as to any particular make of car, but rather they should advocate the interests of the electric vehicle generally. The sale of every car, of whatever successful type, makes subsequent sales easier. The development of the business represents an income of some $75 per car annually to the central station for every new car brought into use.

Asked if he considered it best for lighting companies to take the agency, Mr. Thompson said it is well for them to act as agents for two or three makes of cars, giving the customer a range of selection.

In the discussion that followed Mr. S. F. Smith, manager of the Salem Electric Lighting Company, said more literature should be available and the manufacturers should make greater efforts for business in the smaller cities. His company is putting in charging stations, which will be ready soon.

Mr. Willis M. Thayer, of the Hartford Electric Light Company, reported the status of the business in his city, where one grocer has five trucks. He finds the cost of electricity and repairs is from 1 6/10 cents to 2 cents per mile. His company furnishes battery service at a contract price for the year.

Mr. Fred. H. Smith, manager of the Worcester Electric Light Company, said he was neutral in his attitude toward manufacturers, but was willing to co-operate with all, and urged manufacturers to be active in Worcester. Mr. J. Walter Emery, of the Walker Vehicle Company, suggested that central stations have an inspection service and examine and keep cars in order by the year.

Col. E. R. Bailey believed the average speed of gasoline cars is under 20 miles per hour and that electric cars can average as high a speed. The latter have great advantage in congested streets. Prof. D. C. Jackson, of the Massachusetts Institute of Technology, stated that the institute is compiling data to show the comparative results of horse, gas and electric-vehicle transportation.

Mr. Mansfield reported that the committee on standardization of equipment is endeavoring to secure the adoption of a uniform charging plug for all makes of electric cars. Mr. K. L. Curtis, of the A. & J. M. Anderson Manufacturing Company, exhibited a universal plug which that company has made, which it is hoped will be acceptable to underwriters and lighting commissions. The apparatus meets the requirements of the New York authorities.

ELECTRIC VEHICLE CLUB.

At the first fall meeting of the Electric Vehicle Club of Boston, held on Sept. 13, the committee on charging stations reported that the Lawrence Gas Light Company had opened a new charging station in that city. Mr. March reported that two booklets are being prepared to send to prospective customers for electric vehicles, demonstrating their superiority to gas cars and trucks.

At the club's meeting and luncheon of Sept. 20 were considered in detail the plans under way for the 1912 Boston electric show, to be held Sept. 28 to Oct. 26 of next year. It was suggested that a model garage be established in the basement of the exhibition building, where the operations of charging and caring for vehicles would be conducted as an example to the public, as well as for the accommodation of electric-vehicle owners. Seventeen electric-vehicle manufacturers are represented in Boston, and it is hoped that all will exhibit at the show. Conventions will be held in Paul Revere Hall, in the exhibition building, at which various phases of electrical topics will be treated by experts. The show is expected to be the largest electrical exposition ever held. Floor space to the amount of 110,000 sq. ft. will be available for exhibits. The Boston Edison company, under whose auspices the show is to be held, does not expect to make a profit from the exposition, but is undertaking it with a view to the promotion of the electrical industry and to familiarize the public with the possibilities and economy of electric service. The Edison company will charge only 3 cents per kw-hour for energy used by the exhibitors. It is the plan of the management to allot the central space in the main floor of the building to electric-vehicle exhibitors. The whole section embraces about 12,000 ft. of exhibiting space.

The committee on charging stations reported that the Salem Electric Light Company had put in charging sets to accommodate twelve to sixteen vehicles and at Waltham the McGregor garage had also installed apparatus. The Waltham Dial Company is also prepared to perform the service. A set of lantern slides, showing various types of electric trucks and cars, is being prepared for use in the electrically operated stereopticon which is used by the Edison company to demonstrate electric developments to the public.

Convention of New England N. E. L. A. Section.

The fall convention of the New England Section of the National Electric Light Association was held last week at the Mount Washington, Bretton Woods, N. H. The session opened with an informal reception and dance on Wednesday evening, Sept. 27, about 200 having arrived, mostly by morning train from Boston, to which special parlor cars were attached for members and guests. A considerable number came by automobiles.

The session on Thursday morning was given over to reports and a paper on "Synchronous Condensers," by Mr. C. T. Mosman, of Boston.

SYNCHRONOUS CONDENSERS.

In outlining the operating characteristics of the over-excited synchronous motor as a condenser, the author applied the theoretical considerations to practical problems to show the conditions under which it is advantageous to install synchronous condensers for improving the operating conditions. The author stated that if in an existing plant the prime movers are running underloaded while the generators are loaded, or the raising of the power-factor by a reasonable amount will allow the shutting down of the generator unit, or the generator field coils are overheated, or the exciting system is not able to deliver sufficient voltage to maintain the generator voltage, or the wire and cables are overloaded on some feeders due to low power-factor, then the installation of synchronous motors or synchronous condensers on the feeders should be considered. Attention was called to the use of synchronous condensers by the Utica Gas & Electric Company, the Taunton municipal plant, the Attleboro Steam & Electric Company and the Hartford Electric Lighting Company.

After an early luncheon most of the company, including ladies, made the trip by cog-wheel railroad to the summit of Mount Washington. The atmospheric conditions were perfect and the view from the summit was all that one could ask, though the prevailing gale and a temperature of 22 deg. made the short stay somewhat trying. The five cars, each attended by its tiny, tip-tilted locomotive, then conveyed the party to the base, whence a combined train carried them back to Bretton Woods.

The banquet in the evening was a star feature of the convention. President Howard T. Sands introduced the speakers, Gov. Robert P. Bass, of New Hampshire, and Secretary T. Commerford Martin, of the National Electric Light Association. The latter had come by the fastest means available, from Chicago.

In introducing Governor Bass, Mr. Sands referred to his having been the leader in the fight for public-service regulation in New Hampshire.

REGULATION OF PUBLIC UTILITIES.

Governor Bass said that the people of the State had come to realize that uncontrolled monopolies are a menace to the public. "We ought to have real and not a semblance of regulation," he said. "Massachusetts led in providing limited regulation through its gas and electric light commission. By this means it protects the public without assuming absolute power." He declared that such regulation had resulted in placing the securities of lighting companies on a higher plane. He believed a commission ought to go to the length of having power to compel companies to comply with its decisions. He cited Wisconsin as the state having the most comprehensive regulation. New York, "under the compulsion of Governor Hughes," adopted a regulative tribunal. Connecticut, Vermont and, just recently, New Hampshire have provided commissions of regulation.

Governor Bass held that a commission's powers should secure to the public adequate service—that adapted to the needs of the community and the safety of employees.

An electric-lighting company should be relied upon to furnish good service because it pays to do so. The public is most interested in a low rate and often cannot discern the relation between the quality and price of service of this character. The rate ought to be high enough to secure good service and allow a fair return on the investment. "So long as electricity is sold at 2 cents for motor service and 15 cents for lighting some confusion is bound to arise in the public mind," the Governor declared.

Furthermore, the public ought to see to it that stock in such corporations is not watered. There should be close public regulation of stock issues. Such a rule should be acceptable to good business men, if not to promoters.

A commission ought further to protect the small consumer from the compulsion of helping to pay for the energy supplied to the large consumer. He recognized the advantages of a single company serving a given field and believed that to do its work effectively such a corporation should be protected from crippling competition.

New Hampshire, said Governor Bass, now has carefully drawn laws to safeguard both the consumer and the investor. Its public service commission is composed of able, fair-minded men. The State asks for the co-operation of public service companies with the new commission.

The next speaker was Mr. T. Commerford Martin, to whom the chairman happily referred as "the father of the association, to whom we all turn for advice and help in time of need." Mr. Martin said that there should be no objection to fair regulation, "but there are metes and bounds." The demand for regulation recently reached the proposal to give local authorities control of public utilities in the State of Oregon, but fortunately the scheme failed. In St. Louis the local public service commission scaled down the valuation of property bought by the city over $4,000,000. "Heaven save us from such regulation as that!" Mr. Martin exclaimed.

A recent visit to the Pacific Coast had shown the speaker that the training received by central-station men in New England was effective in placing them in prominent positions elsewhere. He brought an invitation from the Pacific Coast associations to meet with them in convention in Seattle, Wash., in June of next year.

Engineering methods, said Mr. Martin, are making rapid changes in our social and industrial relationships. A few years ago the mechanical problems were uppermost. Today the concern of electrical men is more in the direction of government, the public and also the employee.

At the conclusion of the exercises President Sands said he felt sure Governor Bass would receive the co-operation of central-station owners and managements and called for three cheers for the Governor, which were given heartily.

The technical session of Friday morning opened at 9:30. At this time a driving snowstorm outdoors gave the landscape the aspect of Christmas. Mr. W. H. Vorce, of the Vermont Power & Manufacturing Company, of St. Albans, Vt., read a paper on "The Development and Application of Electricity for Domestic Uses."

ELECTRICITY FOR DOMESTIC USES.

After outlining the history of the development of electrical devices in general and heating devices in particular, the author called attention to the fact that the increasing difficulty of obtaining satisfactory servants has gradually created a demand for electric cooking devices, which seems to afford one of the most practical solutions of the domestic problem. Many central-station managers have profited by, and are continuing to reap the benefits of, this service, which it has been possible to render at a comparatively small outlay and with only a slight increase in operating expenses. The present cost of electric heating devices is not prohibitive and when intelligently directed the outlay for energy need not be great, being hardly more than for gas at average prices. However, the chief attraction of electric devices lies in the fact that they make cooking really clean, cool and comfortable and so dainty that practically all of

the processes may be carried on in a dining-room. This pre-eminent feature is particularly appreciated by the householder who is obliged to prepare all of the meals herself, since the food can be served on the table with the least possible effort. With the present standard outfits that are now being offered by some of the manufacturers it is quite possible to produce results that cannot even be approached by any other method. After the necessary ingredients have been combind in the proper manner, the cooking itself is actually determined by a clock and is no longer a matter of guesswork or uncertainty.

The author described briefly some results obtained with an ordinary commercial fireless cooker having three compartments, the center one, 12 in. in diameter and 14 in. deep, being the only one equipped with an electrical heating element. Tests showed that with an input of approximately 100 watts it is possible to produce and maintain a temperature of about 400 deg. Fahr., which proved to be sufficient for ordinary roasting or baking. With this outfit, a toaster and 6-in. stove all of the cooking for a family of four was successfully accomplished at an expenditure of 9.6 kw-hours for all of the meals prepared for six days. The following results relating to the time required and energy used were obtained with the above-mentioned outfit: Baking two loaves of bread, 60 minutes, 0.1 kw-hour; baking one batch of biscuits, 50 minutes, 0.083 kw-hour; baking two pies, 60 minutes, 0.1 kw-hour; baking ten potatoes, 180 minutes, 0.3 kw-hour; baking three-layer chocolate cake, 50 minutes, 0.083 kw-hour; baking sponge cake, 50 minutes, 0.083 kw-hour; baking six custards, 50 minutes, 0.083 kw-hour; boiling potatoes, 150 minutes, 0.125 kw-hour; roasting 5 lb. of beef, 160 minutes, 0.267 kw-hour; roasting 4.75 lb. of lamb, 120 minutes, 0.2 kw-hour; boiling large ham, 120 minutes, 0.2 kw-hour; boiling oatmeal, 120 minutes, 0.2 kw-hour; boiling corned beef, 120 minutes, 0.2 kw-hour.

Discussion.

The paper, being of an exceedingly practical nature, called forth an extended discussion on the part of members. Mr. John West, of the Malden (Mass.) Electric Company, urged that to the devices mentioned should be added the electric refrigerator. He said that in wiring houses electricians should make provision for the ultimate introduction of food-preparing apparatus in kitchens and dining-rooms.

Mr. L. D. Gibbs, of the Boston Edison Company, described the House of Edison Light, now located at Newton Center, Mass., a description of which has already been given in the *Electrical World*. He stated that advertisements showing views of the house are being sent to prospective customers within a radius of 10 miles. While the house was located at Winchester, another suburb of Boston, the attendance averaged about 100 persons per day.

Mr. A. T. Holbrook, of the Excess Indicator Company, of Boston, stated that in Altoona, Pa., so many electric flatirons are in use that the lighting company was obliged to ask some of the larger motor users to shut down on Tuesdays, when the irons were in general use. He asked if it were not a matter calling for too great expenditure to secure the small household appliance business. Does it pay? To this a member responded that central-station people are not looking for profit on the introduction of new apparatus so much as to make the service as a whole necessary and attractive to householders.

Mr. F. L. Ball, of the Haverhill Electric Light Company, believed the cost of many of the devices is too heavy for the average householder. On the point made by Mr. Vorce that the cost of heating by electricity ought to be as low as 2 cents per kw-hur he doubted if most companies could afford to furnish the energy at that price.

Dr. Louis Bell, of Boston, said a campaign of education in the use of cooking apparatus, etc., should be undertaken. The subject requires a proper understanding of processes to be successfully carried on. He said attention should be called especially to the superior convenience of the electric devices. The gas companies were obliged to develop the uses of gas by long and persistent efforts; so also the electrict-lighting people must do.

Mr. Sands closed the discussion by calling attention to the fact that a more general use would result in lower prices; meanwhile the central-station companies must bear the burden of small or even no returns.

ACCOUNTING FOR SMALL CENTRAL STATIONS.

The next paper was by Mr. H. E. Gidney, auditor of the Malden Electric Company, on "The National Electric Light Association System of Accounting as Applied to Small Plants." Mr. Gidney claimed that so much depends upon a good system of accounts that all persons who have not yet adopted the system recommended by the N. E. L. A. should do so without further delay. The N. E. L. A. system of accounts is very useful as a basis of classification of subjects for correspondence and filing. Moreover, a company should have an accurate record covering the cost and description of property installed, not only for the use of the officers of the company, but for the purpose of obtaining the necessary authority from state commissioners to issue capital stock, bonds and other funded debt. He claimed that the N. E. L. A. standard classification of accounts is sound in principle and practical in scope and that it has been employed by a large number of companies throughout the United States and been found to meet their requirements satisfactorily. By its adoption a company will be able to make intelligent comparison with the results obtained by other companies using the same system. It is unnecessary to adopt the full classification of expense accounts, but the eight main divisions should be adopted by all companies.

Discussion.

In the discussion of Mr. Gidney's paper Mr. E. A. Barrows, of the Narragansett Electric Lighting Company, of Providence, R. I., said that the importance of correct accounting is being recognized more and more, now that public authorities demand a knowledge of details of public-service corporations. The system recommended is well adapted to lighting companies operating under varying conditions, because it is flexible. The meat of these accounts lies in the kw-hour averages, which are valuable for comparison with other periods and other companies. His company handles extensive accounts in detail. Income estimates and costs of extensions are compared and a standard for future extensions is thus established.

Mr. Sands said that the central-station manager to-day ought to know every thirty days just where he stands and not wait until the end of the year, as was the habit formerly.

The last paper of the session was by Mr. B. F. Fisher, Jr., of the Westinghouse Lamp Company, on "The Wire-Type Tungsten Lamp."

WIRE-TYPE TUNGSTEN LAMP.

Mr. Fisher stated that, although there are many processes of manufacturing tungsten filaments, all of them necessarily start with crude tungstic acid and end with pure tungsten. According to one of the principal processes, the paste made from tungstic acid by chemical process is forced through diamond dies and the filament is formed by electrical treatment, whereby all foreign matter is burned out of the paste and the particles of tungsten are sintered together into a continuous wire of pure tungsten. According to another development, there is obtained pure tungsten which is ductile when cold. The author stated that the property of ductility when cold is not natural with tungsten, and when heated to a high temperature the tungsten wire which has been made ductile will immediately start to crystallize to its natural state and become brittle when cold. He reported the results of tests which tend to show that tungsten filaments obtained by either the sintering process or draw-

ing process are of approximately the same tensile strength when the lamps are ready for shipment, the only difference being in the manner in which they retain their strength, which is slightly in favor of the sintered filament so far as percentage and uniformity are concerned. The appearance of the filaments is slightly different, in that the formed filament is of bright steel color with matt surface, whereas the drawn filament is of slightly darker color with a smooth surface. The electrical characteristics as to resistance, both while hot and while cold, are approximately the same and the ability to withstand high temperatures is the same.

One of the weak points in tungsten lamps has resulted from the rigid method of support. In the so-called wire type of lamp use is made of a filament in one continuous length from leading-in wire to leading-in wire, the filament being wound on supporting anchors so that it is free to move within these anchors, and is connected to the leading-in wires by flexible joints. To obtain flexibility in this type of lamp, the rigidity of the joint is overcome by wrapping the filament around the leading-in wire back of the joint, thereby obtaining the flexibility of a coiled spring. The lamps are sufficiently rigid to withstand all the ordinary abuse incident to use and they can be depended upon for any class of service. For example, a certain steam road subjected twelve 60-volt wire-type lamps to 400,000 shocks on a vibrating test without losing a single lamp.

At the conclusion of the reading of the paper Dr. Bell asked for more information on the subject of the transverse strength of the wire-tpye tungsten lamp, saying that the tensile strength is purely incidental. Mr. Fisher replied that the filaments are being made more dense than formerly.

It was voted to send a telegram of congratulation to Mr. James E. Davidson, a former president of the section, lately elected president of the Northwestern Electric Light Association, comprising the five States of Washington, Oregon, Idaho, Montana and Utah. A letter was read from Miss Harriet Billings, assistant secretary of the National Association, thanking the convention for its invitation to be present and speak. The question whether to hold one or two conventions a year in future was discussed, but no action was taken on the subject. The total registration of the convention was 230, of whom sixty were ladies.

Chicago Convention of the I. E. S.

The fifth annual convention of the Illuminating Engineering Society, held in Chicago, came to a close on Thursday, Sept. 28. According to the last official announcement the total attendance was 252. Of this number 142 were members, ninety-three guests and seventeen out-of-town ladies. This registration did not include the names of some who came late, and it is probable that the total attendance was about 275. Three of the seven sessions were reported in the *Electrical World* of Sept. 30, and the proceedings of the remaining four are summarized herewith.

SECTION DEVELOPMENT MEETING.

On Tuesday evening a section development meeting was held in the Congress Hotel, attended by the various section officers and managers. The session was presided over by General Secretary Preston S. Millar, of New York, and matters of constitution revision and membership dues were discussed.

The committee on constitution and by-laws of the society, comprising Mr. W. D. Weaver, New York, chairman; Mr. L. B. Marks, New York, and Mr. Preston S. Millar, New York, laid before the meeting its suggestion for changes in the constitution, inviting the approval of the section managers before presenting the amendments before the general society. The revisions indicated were chiefly of a routine nature, with the exception of the proposal to increase the number of section managers from two to five, to which the approval of the executive and advisory committees had been given. The other changes suggested were: Leaving to discretion of the general board of managers the matter of mailing to each member full membership roll yearly; revision of election methods of counting ballots, so that new officers can be officially informed of their election without waiting until annual meeting; provision to allow officers to sign checks on society's account in case of prolonged absence of secretary; change of annual meeting until date some time later than close of fiscal year, and provision for general secretary to take direct charge of revision of papers. The meeting approved these suggestions and at the regular convention session the following day the amendments were presented to the membership for the purpose of getting the one hundred signatures necessary to effect a change in the constitution.

A proposal to increase the membership dues from $5 to $7.50 a year met with objection from several of those present at the section meeting, who expressed the fear that this increased charge would cause a decrease in the membership of the society. Mr. L. B. Marks explained that the annual cost per member is now $6.50, the difference between this amount and the $5 annual dues being met from advertising in the *Transactions*. The moral and ethical advantages of having the society self-sustaining without the aid of outside commercial interests were urged by Mr. Marks, and the matter of a classification of membership under two or more grades paying different annual dues was also discussed, but no action on the matter of dues was made at the meeting.

PERFORMANCE AND COST DATA OF ILLUMINANTS.

The paper of Messrs. W. Harrison and H. H. Magsdick, of Cleveland, on "The Analysis of Performance and Cost Data in Illuminating Engineering" was presented Wednesday morning.

The authors presented arguments to show that in forming a satisfactory judgment of the relative values of lighting units consideration must be given to the cost as well as to the illuminating power. In determining the total operating cost of any system of lighting three items should be considered, namely: Fixed charges, which include interest on the investment, insurance and taxes, depreciation of permanent parts, regular attendance and other expense which are independent of the number of hours of use; maintenance charges, which include renewal of parts, labor and all costs except the cost of energy; cost of energy, which depends upon the hours burning and the rates charged. There is at present a demand for the establishment of equitable standards, so far as possible, and the compilation of data on commercial light sources in accordance with these standards. Work of this nature, when accomplished, will be of positive benefit both to the consumer and to the illuminating engineer.

Discussion.

Mr. Norman Macbeth, of New York, spoke of the difficulty of selecting the properly equipped but impartial operators to make the authoritative tests referred to by the authors. Prof. Sidney W. Ashe, of Harrison, N. J., said that while it is possible to determine the laboratory values of illuminants accurately there are the usual difficulties in reducing such results to values applicable for lamps in practical service. He also referred to the expense involved in making a set of private tests. Mr. R. B. Hussey, of Lynn, Mass., in discussing methods of street lighting analyzed the lamp costs depending on the hours of burning. For test purposes he also advocated the use of the volt-ampere basis, taking into consideration the power factor of the lamp. Mr. L. B. Eichengreen, of Philadelphia, said that although in testing gas lamps it is the effort to simulate service conditions, an allowance of 50 per cent depreciation value should be made. A gas lamp which had been in service 500 hours in a kitchen under severe conditions of grease and dirt was found to have depreciated 29 per cent, but after

cleaning returned to within 6 per cent of its original value. An indirect lighting installation after one year's service was found to have depreciated 50 per cent, but on cleaning was almost entirely restored. Mr. G. H. Stickney, of Harrison, N. J., referred to the disadvantages which may follow from too keen a competitive attitude between manufacturers, calling attention to the benefits of co-operation. Many large users, he said, are now making thorough investigations of illuminants under conditions which promise results more impartial, of course, than might be obtained by any manufacturer, however careful. Mr. R. F. Pearse said that the problem of the engineer is that of securing the greatest economy of illumination in terms of the energy expended. Mr. J. R. Cravath, of Chicago, declared that under some conditions the minimum values of lamp ratings must be used, as in the lighting of large areas where in certain parts of the room the intensity must not go below a fixed quantity. In closing the discussion Mr. Ward Harrison, of Cleveland, spoke of the appointment of an editing committee to revise such data on illuminants for the society's *Transactions*. He also referred to the importance and advantage of periodical cleaning of lamps and reflectors. A short interval should first be required between cleanings, he said, to impress the habit upon the man in charge, after which the latter may use his own judgment.

COMMITTEE ON PRESIDENT'S ADDRESS.

Following Messrs. Harrison and Magsdick's paper on cost data the report of the committee on the president's address was presented by Chairman J. R. Cravath, on behalf of the other members, Mr. W. H. Gartley and Dr. H. E. Ives. In this report Dr. Kennelly's paper was referred to as a classical discussion of a subject of great importance to illuminating engineering development. In illumination determinations the quantities and methods of measurement are not alone physical, but involve the physiological function of the eye, and the ideal of the experimenter would be to express light flux in a logical system of absolute units. While this is perhaps not immediately practicable the report observed that the scientific units of one age become the practical units of the next.

Dr. E. P. Hyde, of Cleveland, said that the appointment of a committee on research had long been contemplated, but had never been carried out. Mr. P. S. Millar, of New York, advocated the immediate appointment of such a committee, and suggested that resolutions to this effect be communicated to President Kennelly.

EVALUATION OF LAMP LIFE.

Mr. P. S. Millar abstracted the paper on "The Evaluation of Lamp Life," written by himself and Mr. L. J. Lewinson, of New York.

The authors outlined the history of the introduction of the 80 per cent candle-power criterion of useful life of incandescent lamps. In this country practically all specifications for plain and treated carbon lamps employ this basis of evaluation of lamp life, and in much of the practice it is gaining consideration in tests of tungsten-filament lamps. Among the disadvantages of the 80 per cent criterion was mentioned the fact that photometric errors of 1 per cent or 2 per cent, which are likely to be encountered in commercial work, may lead to inaccuracies in the evaluation of the life of as much as 5 per cent or 10 per cent. Moreover, the method assigns exaggerated importance to elements believed to be of lesser value, as a result of which other more important elements fail to receive due recognition. The authors claimed that the burning hours corresponding with the given candle-power depreciation do not afford a measure of useful life. They constitute merely a measure of the net rate of candle-power depreciation throughout a given period. They represent values which, generally speaking, vary inversely as such net rate of decline.

The authors proposed that the lamps be evaluated in terms of their candle-hours per watt throughout the test period divided by the hours in such period. According to the method proposed, the results are not subjected to the exaggerated effect of difference in candle-power maintenance, as under the old method. Test errors, particularly errors in photometric measurements, will affect final results very slightly. Improper selections of test periods will affect the final evaluation to a lesser degree than similar improper selection of candle-power decline elements under the present method. Most important of all, the adoption of the proposed method will attribute more nearly correct importance to the burning-out element, which under the old practice was somewhat obscured by the too complete reliance upon the candle-power element of performance. One prominent difficulty in the way of the application of the proposed method is the necessity for selecting some test period to represent the useful duration of life. In appraising the life of a lamp at any value short of the total burning hours risk of undervaluing the lamp for certain classes of service is incurred. This is a risk which for general purposes it is desirable to take, in order to secure a high standard of lamp performance which places a premium upon good candle-power maintenance and high efficiency, and does not hesitate unduly in penalizing long-drawn-out life when such life involves relatively low candle-power efficiency.

Discussion.

Mr. E. J. Edwards, of Cleveland, Ohio, said that the worth of a lamp to the customer is not measured alone in candle-power-hours. Considering the total light produced in one of the instances cited by the authors the difference on the new basis, he said, amounts to less than 1 per cent. He also made objection to the expression "candle-power-hours per watt," used in the paper. Mr. J. W. Howell, of Harrison, N. J., said that the determination by per cent of candle-power is natural, while that by hours is arbitrary, since lamps lose usefulness both by breaking and decline in candle-power. The older method, he pointed out, tends to exaggerate the difference in ratings, and as a result has probably been a stimulus to the improvement of the tungsten lamp. Mr. Ward Harrison, of Cleveland, Ohio, also pointed out the difference in apparent value between lamps rated by the old method and on the new basis. Taking one of the examples cited in the paper he showed that the cost of energy is more important than the lamp cost itself. Dr. E. P. Hyde, of Cleveland, recommended that the committee on nomenclature and standards consider the new method of rating described in the paper, and if it should think it advisable recommend the use of this basis for evaluating lamp life.

PHOTOMETRY OF LARGE LIGHT SOURCES.

The next paper, by Messrs. George H. Stickney and S. L. E. Rose, of Harrison, N. J., on "Photometry of Large Light Sources," was presented by Mr. Rose.

The authors outlined some of the particular features involved in the photometry of large and powerful light sources and described briefly the methods that are employed by the General Electric Company. Use is made almost exclusively of photometers that show the space distribution of the candle-power rather than those of the flux integrating type. For the past six years the constant-length and constant-intensity photometers have been practically abandoned in favor of the constant-radius photometer. This photometer affords a definite measure of "apparent candle-power" at the chosen distance, and from this value the mean spherical candle-power can be calculated.

The real difficulties in the photometry of large units are those introduced by the variation in color and intensity of the light. It is not uncommon to find reading varying from 20 per cent to 300 per cent of the mean. To minimize the errors attributable to variation in intensity either the maximum and the minimum intensities

measured are averaged or a large number of measured intensities are averaged.

The working candle-power standards are 40-watt tungsten lamps, which are checked at least once a week against substitution standards consisting of 250-watt tungsten lamps carefully seasoned and checked against two or more reference standards. The reference standards are carbon incandescent lamps with parallel-type filament furnished by the electrical testing laboratories and verified by the bureau of standards.

Discussion.

Mr. Preston S. Millar, of New York, spoke of the difficulty of measuring fluctuating light sources, and discussed matters of technique in the use of the photometer. Dr. H. E. Ives, of Cleveland, suggested the application of a photometer using the light of the lamp under test itself for comparison with its distribution in various directions to obtain the distribution curves of those lamps whose flux output varies widely. The fluctuation of certain classes of arc-lamps is due to variation of flux output rather than of distribution, and as such changes occur the accompanying variation of the temporary comparison standard with the flux under test would eliminate the results of these variations. After such a distribution set of tests had been made the whole set of results could be reduced to absolute units by a single comparison against a standard source. Mr. W. J. Cady, of Newark, Ohio, called attention to the effect of absorption in mirrors. He also described briefly the large photometer of the Holophane Company at Newark, which takes up three floors. Mr. W. F. Little, New York, said that he has found quick snap readings superior to slow, studied ones. The use of sectored disks he found to give trouble in photometering alternating-current lamp sources. Mr. F. H. Gilpin, of Philadelphia, described the use of a rotating disk screen with elliptical openings at the mirror. Mr. R. B. Hussey, of Lynn, Mass., said that in measuring arc lamps the double mirror is often little superior to a single mirror, since it is the total flux rather than the distribution of the lamp which varies from time to time. In a written communication Dr. A. S. McAllister, of New York, noted that the term "candle-power," unmodified, is not trustworthy when applied to lamps having parabolic or focusing reflectors. He also pointed out that a constant-radius photometer gives an absolutely accurate measure of the mean spherical candle-power.

PHOTOMETRY AT LOW INTENSITIES.

At Wednesday afternoon's session a paper on "Photometry at Very Low Intensities," prepared by Dr. Louis Bell, of Boston, was read by Dr. H. E. Ives, of Cleveland.

After calling attention to the difficulties encountered when attempting photometry with illuminations of less than 1 meter-candle, the author reported the results of tests showing that the difficulties can largely be overcome by "dark-adaptation," since a very little dazzling from stray light will spoil one's shade-perception, for joint differences in intensity-prolonged adaptation put the eye into a condition in which it can discriminate joint illumination in a way that is altogether surprising to those who have customarily worked with fields of ordinary intensity. The sensibility in dark adaptation increases slowly with increasing rapidity for the first ten minutes, increases at a prodigious rate for the next forty minutes, and then slowly reaches a constant value perhaps 8000 times the initial in about one hour.

With an imperfectly adapted eye exposed to casual light both shade perception and acuity are uncertain at illumination below 1 meter-candle, the fact being that with illuminations near and below 0.2 meter-candle the ability to discriminate between photometer fields is practically a junction of adaptation and has no significant mean value. However, with reasonably good dark-adaptation light-intensity discrimination is reliable down to the very lowest illumination. Under dark-adaptation acuity shows indications of great increase and there are found at least signs of returning color vision.

Discussion.

In opening the discussion Dr. P. W. Cobb, of Cleveland, called attention to the wide ranges of illumination through which the eye is capable of seeing and the variation of functions which control vision at various intensities. Although the idea is generally held that the rods and cones functionate separately, the cones giving the color sense at high intensities, while the rods give merely the white-light sense at low intensities, such a hypothesis is in part discredited by the fact that at very low intensities color vision is now found to return, although it had been supposed that the color sense was alone resident in the cones, which have very slight adaptation over a range of illumination. Prof. S. W. Ashe, of Harrison, N. J., said that all three of the elements of adaptation, glare and fatigue are involved in low-intensity measurements, and that fatigue must be properly recognized and accounted for if trustworthy results are to be obtained. Dr. H. E. Ives, of Cleveland, reported that during work in photometering various colored lights, using the sectional disk run at a speed where the flicker disappears, the values obtained for Fechner's law show a straight line down to a point where the function suddenly changes direction, thereby indicating that there cone vision has ceased and rod vision remains. While a red-light source gives a straight line a blue source cannot be measured at very low intensities.

EFFECTIVENESS OF LIGHTING.

Mr. J. R. Cravath, of Chicago, followed with his paper on "The Effectiveness of Light as Influenced by Systems and Surroundings."

In the paper were recorded the results of tests relating to the comparative effectiveness of direct and indirect lighting systems as at present commonly installed, in order to ascertain whether indirect installations should be designed for a higher or lower foot-candle intensity than direct installations.

The tests were conducted in a room 18 ft. 8 in. wide by 21 ft. long, the ceiling height being 10 ft. All daylight was excluded. The ceiling and walls were of ordinary smooth plaster, very light cream in color, and the floor was a reddish brown. In certain of the tests black curtains were so hung as to have the surroundings of the persons making observations entirely dark, except the small area of desk, paper and photometer plate. There were five outlets, one being located in the center of the ceiling, and the other four in approximate centers of the four quarters of the room. Both the flux of light and the position of the lighting units were varied until persons seated at the desk expressed satisfaction with the amount of illumination provided for reading purposes.

The paper contained records of tests made with twelve different subjects, ten readings being made with each subject in each test. The tests showed that within the range of commercial practice there is nothing in the theory that the eye requires less illumination on the work amid dark surroundings, or with dark walls, than amid light surroundings with good diffusion of light. In fact, the reverse is true. The author expressed the belief that the explanation is to be found mainly in the matter of glare on the paper of the reading page. It was found that most of the subjects desired more light on the paper when the desk was in the center of the room, under the principal source of light, than when the desk was at one side of the room. This applies to both the direct and indirect systems of lighting.

The author concluded from the tests made that under ordinary working conditions the diffused character of

the light falling on the work has more influence on the comfort of seeing and the amount of required illumination than has the brightness of the surroundings. The greater the percentage of diffused or indirect light and the less the percentage of direct light from small sources the more satisfactory is the system likely to be for work under varying practical conditions. Extra brightness of surroundings with a diffusing lighting system may be produced experimentally which will necessitate higher illumination on the work, but for economical reasons such extreme conditions are not likely to become common, because they would be costly and troublesome to produce commercially. On account of the impossibility of properly diffusing the light to secure comfortable illumination on the work with dark surroundings under ordinary conditions of use, the glare from the work practically more than counteracts any gain in visual acuity in having the surroundings dark.

Discussion.

Mr. A. J. Sweet, of Newark, Ohio, commented on the growing attention now being given to the efficiency of light utilization at the eye and the significance to commercial development of the movement represented by Mr. Cravath's paper. ' While he admitted that Mr. Cravath's results are remarkably consistent, he observed that they are yet not really quantitative, but only "indicative" of the conclusions which the author had seen fit to draw. With a large number of unknown variables, said Mr. Sweet, a great number of tests would be required to fix any conclusion. Taking up the tables of Mr. Cravath's paper, the speaker analyzed them with the view of showing that in each case it was rather the instances of unidirectional lighting than indirect lighting which had required the higher intensities. The charge of glare effect, he therefore concluded, is not proved in the data submitted. Prof. S. W. Ashe, of Harrison, N. J., said that although a variety of test methods might be used in such determinations as the paper described, Mr. Cravath's explanation of his own method was very clear and his results should be easily duplicated if necessary. Acuity of vision, he pointed out, is affected by a great variety of conditions. Mr. A. J. Marshall, of New York, inquired the times of sittings and the times of day when the tests were made. In indirect-lighted rooms, he said, he had noted marked evidences of fatigue on the part of subjects. He indicated a line of fatigue tests which he proposes making on school children at the beginning and middle of both morning and afternoon school sessions, carrying out the tests for direct, indirect and semi-indirect lighting. Mr. Albert Scheible, of Chicago, who was one of the subjects of Mr. Cravath's tests, testified to his own difficulty in judging accurately the points he considered "comfortable" and "ample" illumination. The tests, he said, were made at a time of day when his own eyes were fatigued. A foreign experimenter whom he next quoted has found, said Mr. Scheible, that to avoid fatigue an intensity about twenty-five times the minimum possible visible value is required. Mr. F. J. Pearson, of Chicago, another of Mr. Cravath's subjects, declared that in his opinion too much latitude was left to the subject, and that unless the average subject had been a professional proofreader or other worker accustomed to continuous use of his eyes he could hardly be expected to estimate within a few minutes the values of intensity which he would consider comfortable for several hours' reading. Mr. Norman Macbeth, of New York, asked whether the results of a given subject were fairly uniform throughout the series or whether the values ranged over wide minimums and maximums. Mr. E. L. Elliott, of New York, remarked that with the wealth of physical data available to the illuminating engineer the important field of physiological subjects touched on by Mr. Cravath's paper is almost barren. He also cited an instance where a large institution had tested several systems of lighting in a room where 200 office workers were employed. After two weeks' experience with each of the several systems the vote was unanimous for the indirect-lighting method. While a bare lamp in the line of vision will for a brief time actually improve the vision of objects beyond, said Mr. Elliott, the painful and injurious eeffct of glare soon makes further vision impossible. Mr. F. L. Godinez, of New York, in a communication read by Mr. Lewinson referred to the effect of age on vision and the psychological importance of the character of illumination selected. Under these requirements he insisted that indirect illumination is not adapted for the home or for other places of social intercourse where soft shadows are required. In referring to the institution tests reported by Mr. Elliott, Mr. A. M. Klingman, of Chicago, said that the intensities used with the various systems were not the same.

On Thursday morning the discussion of Mr. Cravath's paper was resumed, Mr. L. B. Marks, of Chicago, opening the discussion. While the data submitted in the paper are of much value, he said, they are not conclusive. Differences in color of the lamps as they were brought up through a range of intensities by rheostats might have an influence on the results obtained. He also made the criticism that the comparison of the indirect lighting should have been made with a more carefully prepared direct-lighting system. A test later made by him in the same room where Mr. Cravath's experiments were made, he said, actually showed very little difference between direct and indirect lighting when the bare direct filaments were shaded by even such a simple diffusing medium as a handkerchief. Mr. P. S. Millar, of New York, said that readings should also have been taken of the brightness of surroundings and that the investigation should have divided the problems between those of diffusion alone and those comparing direct and indirect lighting, in which case even more important lessons might have been learned. A written communication from Mr. Bassett Jones, of New York, read by Assistant Secretary Langen, declared that Mr. Cravath's paper was simply a research into the effect of glare, and that the direct system of lighting used in the tests should have been arranged with care and judgment equal to those employed in setting up the indirect lighting. For many kinds of illumination, the writer concluded, a combination of direct and indirect lighting will be found most satisfactory. Mr. J. D. Israel, of Philadelphia, congratulated Mr. Cravath on the new line of investigation opened up by his paper. In reply to those who took part in the discussion Mr. Cravath called attention to the fact that conditions of diffusion are always very closely associated with surroundings and that it is almost impossible to divorce poor diffusion from dark surroundings. To make such a distinction, while perhaps of academic interest he admitted, would not be of practical or commercial use. Mr. Cravath said that he had watched for the fatigue referred to by previous speakers, but had reached no conclusions regarding its existence. The author also remarked in response to Mr. Marks' reference to his own supplementary test with handkerchief-covered direct lamps that the loss in thus screening the lamps had brought their efficiency even below that of the indirect-lighting system. In conclusion he urged more attention to glare from work caused by unidirectional light and to securing diffusion. This he said was the main lesson from his tests.

DAYLIGHT ILLUMINATION.

Following the discussion on Mr. Cravath's paper Dr. Ives presented the paper written by himself and Mr. M. Luckiesh, of Cleveland, on "Distribution of Luminosity in Nature."

The authors employed a photographic method of photometry for measuring the distribution of relative brightness in the vertical plane exposed to view in certain scenes in nature. Use was made of an absorbing screen to render the photographic action of different colors proportional to visual brightness. The photographs made through this

screen were measured for density at each point, and the distribution of brightness in the field of view was thereby determined.

Reports were given in the paper of observations made of two pleasant landscapes, two views of the same open landscapes under different conditions, a shady place in the park, a city street and two street views of remarkably unpleasant but yet instructive character. The result seemed to indicate that the normal eye can tolerate a higher brightness in flux of light above the horizontal than below. The eye recognizes as unpleasant the presence of large areas of nearly uniform high brightness. It can tolerate such a condition in the case of the sky, but it cannot tolerate a uniform high brightness in the foreground. The difference between pleasant and unpleasant conditions seems to lie chiefly in the presence or absence of variety.

The authors made lumeter measurements in order to obtain some idea of the absolute values of the surface brightness. Blue sky was found to measure 2.2 cp per square inch. A cumulus cloud in the same sky measured 10.4 cp per square inch. On an overcast, rainy day the sky had a brightness of 3.3 cp per square inch. On a darker overcast day the brightness fell to 1 cp per square inch. A cement pavement in the sunlight had an intrinsic brightness of 6 cp per square inch. The ratio between the brightest and darkest point of the average vertical distribution in the most varied landscape observed was about 20 to 1. The brightest object photometered was a white cloud, which had about half the intrinsic brightness of a Welsbach gas mantle.

Discussion.

Mr. G. H. Stickney, of Harrison, N. J., said that he had long owned to an instinctive appreciation of the principles contained in the paper by Dr. Ives and Mr. Luckiesh. Mr. Norman Macbeth, of New York, also complimented the authors and said that the paper brings out much valuable and desired information of use to engineers engaged in illumination work. Mr. A. J. Marshall, of New York, spoke of the need of architects' co-operation and conceptions in the design and arrangement of illumination to simulate most closely nature's requirements and standards of distribution.

AN APPLICATION OF THE LAW OF CONSERVATION.

Dr. A. S. McAllister, of New York, presented a paper on "The Law of Conservation as Applied to Illumination Calculations."

The author showed that the "inverse-square law," as applied to light sources of all types, and the "cosine law," as applied to surface sources and the illumination on planes, give results in strict conformity to the law of conservation in that the flux produced by any lighting source is neither increased nor decreased until utilized for illumination, when it is transformed according to the well-established laws of nature. Accordingly there is available an absolutely accurate method of determining the total flux which the lighting source must produce, which consists in multiplying the incident flux density over each surface by the absorption coefficient and in this manner making a summation over all of the areas illuminated by the source.

The paper contains detailed proofs of the equilux-sphere method of determining the illumination obtained from plane circular sources as outlined in our issue for Dec. 8, 1910, and of the absorption-of-light method of calculating the flux outlined in our issues dated Nov. 21, 1908, and May 26, 1910.

Discussion.

Prof. W. E. Barrows, Jr., of Armour Institute of Technology, Chicago, observed that the interesting relations brought out by Dr. McAllister's paper have heretofore gone unnoticed, and he congratulated the author on the simple terms of the demonstration. He also declared his approval of the author's expression of flux in lumens, which avoids the indefiniteness of other units. Dr. M. G. Lloyd, of Chicago, said that the paper gives an excellent short-cut method, but on account of the absorption which is met with in ordinary air Dr. Lloyd objected to "the law of conservation" being stated as a fundamental law of nature. In reply Dr. McAllister stated that the method described is equally applicable under all conditions of absorption, although the greatest simplicity is found by neglecting atmospheric absorption, which is of no importance in illumination problems.

RÉSUMÉ OF LEGISLATIVE ENACTMENTS.

The next paper was by Mr. E. L. Elliott, of New York, and was a "Résumé of Legislative Enactments on Illumination."

After discussing the justification for legislative regulation of illumination, and calling attention to the work of the American Association for Labor Legislation and the American Association for Conservation of Vision, the author stated that the various scientific societies, particularly the Illuminating Engineering Society and the Ophthalmological Society, are natural tributaries to these two organized forces. He claimed that professional and scientific societies may properly be looked to as sources of scientific knowledge and reliable data, but publicity and legislation must be left to the social or humanitarian society. In order to render legislation on the subject of illumination effective, there should be developed a practical illuminometer which possesses the following qualities: Absolute portability, satisfactory accuracy in the hands of non-technical and inexperienced users and moderate cost. With such an instrument available the conditions of illumination can be accurately specified in the labor or factory laws. The paper contained a résumé of the legislation both in this country and in Europe.

Discussion.

Mr. E. F. Crittenden, of Washington, said that it is important to have legislators know and realize that illumination can be measured with fair accuracy, but he added that few, even experienced, observers can rely upon results within 5 per cent using any type of portable illuminometer as suggested by Mr. Elliott. Better, he said, should experienced inspectors be selected for the work, since such men would know how to interpret the results obtained and to apply these results practically. To get manufacturers to provide adequate lighting he recommended that they be shown that good lighting actually pays in increased production of work, instead of simply resting the case on the argument of saving the eyesight of employees. Mr. A. J. Marshall said that his conception of the portable instrument proposed by Mr. Elliott was one which should only supplement the inspector's own eye in making his rounds of factory interiors. In case the illumination should then fall below what the inspector considered necessary an experienced observer might follow with a precision instrument. Mr. G. H. Stickney, of Harrison, N. J., cited examples to show that much of our factory legislation, especially when directed at lighting, misses its real purpose, and that wise and definite laws are needed. Mr. J. R. Cravath, of Chicago, observed that while so many subjects in the field of illuminating engineering are yet indefinite it would after all be difficult for even experts to formulate laws. Dr. Winthrop Talbot, of Cleveland, Ohio, said he had just returned from the conservation congress at Kansas City, Mo., where a great movement has just been launched to conserve human efficiency. Legislation, he said, must not precede education too far. Dr. M. G. Lloyd, of Chicago, urged that the society take steps to abolish glaring automobile lamps. Mr. Elliott, the author of the paper, in

closing said that while many illuminating subjects are still indefinite, his own idea in preparing a set of laws would be to shut off the manifest abuses, some points of which are certain. He also referred to the industrial accidents which are caused by poor illumination, as shown by the greater number of such accidents during the darker months of the year.

ENGINEERING AND SALESMANSHIP.

The last paper of the convention, entitled "Illumination or Equipment," and written by Frank B. Rae, Jr., of New York, was presented by Mr. A. J. Marshall, of New York.

The author claimed that there are to-day little more practical, usable data of actual scientific value on the subject of illuminating engineering than there were three years ago. This condition he attributes to the fact that the true engineers are too much interested in engineering for its own sake, rather than for the sake of the public. Realizing their superiority in this single subject, their effort is to rise further from the mass of humanity, rather than to assist humanity to reach their level. There is need for increased activity upon the part of the Illuminating Engineering Society in the compilation of data which will be of use to the practical man called upon to specify illuminating equipment. The intent of the modern salesman of energy and equipment is to work along scientific lines, and to employ such engineering data and principles as he can grasp. He may pervert these data to selfish ends, but if the data formulated are fundamental and practical they will stand upon their own merits.

Discussion.

Mr. A. J. Marshall said that he disagreed with the author in his declaration that engineers are often over-interested in engineering for its own sake. The purpose of the Illuminating Engineering Society, he pointed out, is to proceed from the complex to the simple, making the subjects and problems of illumination comprehensible to anyone interested. Mr. Norman Macbeth, of New York, said that sometimes those best equipped to collect information will sit by and ask others to collect and digest it for easy use. Mr. E. C. Crittenden, of Washington, D. C., cited an instance where a certain man, an illuminating engineer by title, had showed a deplorable lack of information regarding the effect of reflectors in increasing the apparent candlepower of a light source. Mr. E. L. Elliott said that the problem of where to use science in advertising is often itself an art, and that where scientific facts fail to substantiate the claim which the advertiser desires to make some other form of argument must be resorted to.

RESOLUTIONS.

Before the close of the convention Mr. A. J. Marshall presented resolutions of regret and respect regarding the recent death of Mr. L. R. Hopton, of New York. On motion of Mr. G. H. Stickney, of Harrison, N. J., the thanks of the society were voted to the Chicago Section and to the local committees and commercial organizations that contributed to the success of the 1911 meeting. Final adjournment of the Chicago convention was then taken.

SOCIAL FEATURES AND EXCURSIONS.

On Monday evening, Sept. 25, there was a reception and dance at the Congress Hotel for members and guests and the ladies of the convention. On Tuesday afternoon a number of the visitors made inspection trips to various places of interest. These included the Fisk and Quarry Street generating stations of the Commonwealth Edison Company; People's Gas Building on Michigan Avenue, with its high-pressure gas "arcs" and semi-indirect lighting fixtures; Sears, Roebuck & Company's lighting plant; demonstration room of the National X-Ray Reflector Company; libraries and shops of the Armour Institute of Technology; electric shop of the Commonwealth Edison Company; fixture showrooms of the T. W. Wilmarth Company; lighting features of the Chicago & Northwestern Railway passenger terminal, and the International Municipal Congress at the Coliseum. There were also automobile trips for the ladies on Monday afternoon and Tuesday afternoon (with luncheon at the South Shore Country Club on the latter day) and a theater party on Wednesday afternoon.

The banquet held on Wednesday evening in the Florentine room of the Congress Hotel was of a rather informal character, and for that reason was the more enjoyable. During the earlier part of the evening excellent vocal and instrumental music was provided, and a professional entertainer interspersed songs in which all joined in the chorus. Later in the evening, under the leadership of Mr. Louis B. Marks, of New York, as toastmaster, a few were called upon for informal toasts. Among those responding were Past-presidents W. H. Gartley and E. P. Hyde; General Secretary Preston S. Millar; General George Harries, of Washington, D. C., president of the Association of Edison Illuminating Companies, who was toastmaster at last year's banquet; Mr. Homer E. Niesz, vice-chairman of the general convention committee, upon whom much of the responsibility of the convention arrangements fell, and Mr. Joseph D. Israel, of Philadelphia, who spoke on behalf of the out-of-town visitors to the convention.

The general convention committee consisted of Mr. John F. Gilchrist, chairman; Mr. Homer E. Niesz, vice-chairman, and Messrs. J. C. D. Clark, George C. Keech, F. A. Vaughn, W. E. Barrows, Jr., C. A. Howe, J. R. Cravath, F. J. Pearson, A. T. Hunt, W. C. Bauer and A. L. Eustice. Mr. George B. Foster acted with the committee, and Mr. Albert Scheible as convention arrangements secretary was particularly active in looking out for all details of the convention.

Convention of Georgia N. E. L. A. Section.

The first annual convention of the Georgia Section of the National Electric Light Association was held at Columbus on Sept. 26 and 27, the convention being called to order in the Masonic Temple by President John S. Bleecker, manager of the Columbus Electric Company. The address of welcome to the city was delivered by Mayor Rhodes Brown.

In his presidential address, Mr. Bleecker stated that at the time of the organization of the George Section there were twenty-one members of the National Electric Light Association in the State. Less than six months later, on April 6, 1911, there had been an increase of 100 per cent in membership, and at the present time the total membership is seventy-three, there having been a gain of 239 per cent in less than twelve months. The report of the committee on membership and finance, which was presented by the chairman, Mr. William R. Collier, showed that on Sept. 26 there were 14 Class A members, 38 Class B members, no Class C members, 1 Class D member and 21 Class E members, the total being 73. The chairman expressed the opinion that the large increase in membership during the past year could be equaled in the coming year.

CENTRAL STATION AND INSURANCE.

A paper entitled "Advantages of Co-operative Effort by Central Stations with Insurance Inspectors," by Mr. A. M. Schoen, chief engineer of the Southeastern Underwriters' Association, was read by Mr. F. G. Tupper, on account of the absence of the author. The author stated that, although approaching the subject from different directions and engaging in businesses essentially different in their natures, the electric company and the insurance company have a common interest in the reduction of risks, it being to the interest of both, as well as that of the inspector and the policy holder himself, to protect the latter against damage by electricity either to life or to property. The electrical inspectors for the insurance company devote their entire time to the prevention of electrical fires, and therefore become

specialists in this particular line. They learn of fires that never come to the attention of the central-station manager, and they have at their fingers' ends the details of such occurrences in 100 cities, whereas the experience of the central-station manager has been limited to a very few. Under these circumstances, it would seem that the inspector and the central-station manager should co-operate completely in methods tending to reduce the risks. Unfortunately, insurance companies are unable to maintain a corps of inspectors large enough to keep men constantly in individual places. The result is that most of the municipal inspectors are too busy with politics to care much about how the work under their supervision is done. Some of the inspectors are doing good, conscientious work, but a large part of the offices are absolutely farcical, and seem to be maintained only for political purposes. Mr. Schoen stated that he was not in sympathy with certain rules of the National Electrical Code, but since the majority of the people expressing views on the subject were opposed to his views, he now subscribes to and endeavors to enforce these rules. He stated that so long as each individual insists upon conforming only to what fully coincides with his ideas as to correct practices, chaos will prevail and uniformity in any direction will be impossible. Individuality is a most excellent trait, but when it develops into stubbornness, born of conceit, it ceases to be admirable. Each of the interested national bodies has a representative on the committee intrusted with the work of revising the code, and differences of opinion as to the propriety of any rule contained therein should not form legitimate reason for any unpleasantness between the station official and the inspector.

In discussing Mr. Schoen's paper Mr. L. S. Montgomery, of the National Metal Molding Company, called attention to the fact that the new electrical inspection rules passed by the Des Moines City Council on Sept. 13 require that permits to do electrical work shall be granted only to registered contractors who have filed a bond of $1,000. The newly appointed inspector, Mr. J. B. Dempster, is officially a member of the fire department, and is given authority to enter all premises where electric wiring is installed.

Mr. W. R. Collier, of the Georgia Railway & Electric Company, remarked that so long as politics is mixed up with inspection, the inspector will be unable to give his best attention to the work of inspection. He expressed the opinion that the customer would be willing to pay a small fee, provided by making such payment a good inspection would be guaranteed. Moreover, most central stations would be willing to pay a certain part of the fee.

Mr. E. C. Deal, of the Augusta-Aiken Railway & Electric Corporation, claimed that a high license renders it impossible for many parties without capital to go into the wiring business, and brings about a condition which results in two or three contractors combining and fixing the rate so that it is almost impossible for many persons to enjoy the benefits of electric lighting. He thought that the municipality should control inspection in such a way that the lighting company would not have to bear the burden of any defects in workmanship of the contractor.

Mr. E. S. Roberts, of the Savannah Electric Company, expressed the opinion that the city inspector should be required to pass an examination before he can take office. Such a plan would result in trouble in the political field, but the final outcome would be satisfactory to all parties interested.

Mr. G. K. Hutchins, of the Columbus Power Company, called attention to the fact that conditions with reference to political grafters are very much better at the present time than they were several years ago. Great progress has been made in this direction, so that at the present time the disposition is for the various interests to co-operate.

Mr. Burdett Loomis, Jr., of the Ware County Light & Power Company, outlined the results of the visit of an inspector to Waycross. The inspector ignored the central station, but pointed out defects in the wiring to many of the customers of the central station. Mr. Loomis thought it an unnecessary hardship upon the central station to call attention to poorly insulated wires on aerial secondary circuits. The insulation of such wire never lasts more than a few years, and it is improper for the inspector to imply that new wire should be erected at such intervals.

Mr. Deal claimed that troubles of the nature mentioned by Mr. Loomis can easily be avoided by proper co-operation between the central station and the insurance inspector. The assumption that all independent wiremen are unscrupulous is incorrect; the fact is that most of them are good business getters for the central stations, and many of them do just as much to protect the interests of the central station as does the "new business" representative of the central station itself.

Mr. F. G. Lumpkin, of Columbus, stated that by proper co-operation with insurance inspectors a certain central station has been enabled to reduce its insurance premium by between 10 to 15 per cent, the premium obviously being less when proper electrical wiring is used than it would be with improper wiring.

A motion introduced by Mr. Deal, that the executive committee be asked to appoint a committee for handling all inspection matters, from both an insurance and a municipal standpoint, was carried.

ELECTRICITY IN TEXTILE MILLS.

Mr. George K. Hutchins, of the Columbus Power Company, presented a paper on "Electrical Energy in Textile Mills," in which were discussed some of the merits of the electric motor and its peculiar adaptability to the textile industry. He presented statistics showing that on Dec. 1, 1903, there were installed in textile mills 1053 motors, having an aggregate rating of 64,313 hp; by Feb. 1, 1905, the number of motors had increased to 1740 and the aggregate rating to 87,614 hp; on Jan. 1, 1910, there were installed 10,491 motors, aggregating 302,119 hp, and on June 1, 1911, 16,450 motors were in use, the aggregate rating being 387,975 hp. In the seven and one-half years under consideration the total increase in horse-power amounted to 603 per cent, while the increase in the number of motors installed amounted to 1562 per cent. The statistics showed that the electric drive is fast growing in popularity with the textile industry, for the requirements of which it is pre-eminently fitted, and that the tendency is toward the use of smaller units.

On Dec. 1, 1903, there were fourteen central stations supplying electrical energy to textile mills; on Jan. 1, 1910, there were seventy-nine central stations doing so, thirty-nine of these being operated entirely by steam. Among the distinctive features of the electric drive was mentioned the great flexibility it introduces into all departments of the mill, thus permitting the various processes to be kept balanced and affording economical means in any department for over-time work which might be required for the finishing of special orders. The constant and uniform speed serves not only to secure a better quality of product, but experience has shown that there is obtained a substantial increase in product, conservatively estimated at an average of 10 per cent.

The textile mill affords a very satisfactory demand for energy throughout its running hours, and should furnish an attractive day load for any central station of sufficient size to handle this class of business. The author gave statistics relating to five textile mills in which the average of maximum demand taken for a twelve months' period showed a ratio of demand to the motor rating installed varying from 71 to 96 per cent.

In discussing Mr. Hutchins' paper, Mr. F. P. Catchings, of the Georgia Power Company, stated that of the 2300 cotton mills in North Carolina, about 25 per cent are now driven wholly by electricity. He remarked that the cost of

electrical energy is not the first consideration in comparing electric with other drives; the fact of the matter is that the cost of energy is only about 5 per cent of the total cost of operation. The use of electric energy in the mill enables the production to be increased for the same equipment, and it is this fact which will have to be ultimately acknowledged and met by every mill owner, In a converted mill driven by electric motors one of the following results is always brought about: If the original production is maintained, the amount of energy required is reduced. If the energy required is not reduced, then there will be a considerable increase in production. Although the cost of energy is often set forth as being the essential element, and although the cost of electric energy is less than that of steam, yet the great advantage does not lie in the small cost of the energy, but in the indirect elements, such as the superiority of the electric motor, its general convenience, flexibility and adaptability, and its constancy of speed. The service can be considered from both the quality and quantity standpoint, and it is the quality standpoint which is the more important one. Mr. Catchings claimed that a new mill can be equipped or an old mill converted as a complete installation, as far as electric motors and wiring are concerned, for about $15 per hp maximum, and said the cost had been as low as $12 per hp. The cost of wiring a mill using 2200-volt motors, ranging in rating from 15 hp upward, is approximately $4 per hp. The reasons for applying motor drive in any industry resolve themselves into two main factors, either increasing the quantity of material produced or bettering the quality of the material, or a combination of both, resulting in any case in a reduction in the cost of the article.

One of the greatest advantages incident to the use of electric energy is the application of the graphic meter, by the aid of which are revealed facts the very existence of which may have been unknown before.

PINE FOREST DESTRUCTION.

A paper entiled "The Dying of the Pine, Cause and Remedy," was read by Mr. E. S. Mason, of the Bureau of Entomology, Washington, D. C. In introducing the speaker President Bleecker stated that the central stations are directly or indirectly dependent upon the forests for their well-being, in some cases for fuel and in other cases for water-power, and hence the subject of the paper is one in which central stations are much interested. Mr. Mason stated that the dying of the pine trees can be attributed to beetles. These beetles are attracted to any locality by the smell of pitch, so that when a living pine is cut the beetles are attracted to the neighborhood and immediately attack other trees. If one does not wish to put his timber in danger, he should not cut any living trees during the months of September and October. From November through the winter months the trees that turn light green, yellow or greenish brown should be cut down and their bark destroyed in order to protect the remaining timber.

In reply to questions by Messrs. Charles J. Swift, J. S. Bleecker, G. K. Hutchins, E. C. Deal, C. D. Flanigan, and T. F. Land, Mr. Mason stated that in case lightning strikes a pine tree the tree should be burned in order to remove the odor of pitch which might attract the beetles. Co-operation between neighbors is necessary in order to rid the neighborhood of beetles, but legislative action in this connection would be unwise. Chemical processes for destroying the beetles have not been developed, on account of the enormous expense that would be involved.

STEAM TURBINE.

Mr. E. H. Ginn, of the General Electric Company, Atlanta, Ga., read a paper dealing with the low-pressure steam turbine, by means of which it is possible to utilize efficiently the energy of steam from approximately atmospheric pressure down to 28 in. vacuum. The author stated that 1 lb. of saturated steam expanded with perfect efficiency from a gage pressure of 150 lb. to 1 lb. gage pressure is capable of doing approximately 132,000 ft.-pounds of work. If expanded from 1 lb. gage pressure to 28 in. vacuum, it is capable of doing approximately 118,000 ft-pounds of additional work. On account of the practical limitations of cylinder dimensions and exhaust ports, it is impossible for reciprocating engines to utilize the high degrees of vacuum. In the case of turbines, however, the exhaust chambers and escape ports can be built of any desired size, so that the turbine can utilize successfully the energy which it is impossible to utilize with the reciprocating engine. The effect of adding a low-pressure turbine with a condenser to a reciprocating-engine system is almost to double the permissible output of the plant, without burning any more fuel and without increase of boiler equipment. On the other hand, if reciprocating engines were re-arranged for condensing operation, and condensers were installed without low-pressure turbines, the maximum gain in output would not exceed 25 per cent. For example, the author showed that in a certain installation the maximum load which a reciprocating engine unit would carry was 1265 kw non-condensing and 1470 kw condensing, and with a low-pressure turbine the maximum load that can be carried with the same system would be 2500 kw.

In reply to questions by Messrs. J. T. Chambers, of Atlanta; E. C. Deal, of Augusta; C. M. Young, of Columbus; W. R. Collier, of Atlanta, and J. H. Adams, of Augusta, Mr. Ginn stated that the amount of steam consumed by the auxiliaries in low-pressure turbine installations does not exceed 6 per cent. The result of losing vacuum entirely is practically the same as losing steam pressure, all of the power of the turbine being lost. However, when a mixed-pressure turbine is employed the load is carried properly even when the vacuum is lost. When admitting high-pressure steam into a mixed-pressure turbine, no trouble is caused by the intermixture of high-pressure and low-pressure steam.

ELECTRIC HEATING DEVICES.

Mr. L. L. Warfield, of the Westinghouse Electric & Manufacturing Company, Atlanta, read a paper in which were briefly described various types of electric heating devices. The author claimed that since all the energy supplied to the resistor produces heat, the efficiency of the resistance material cannot be improved, and hence any advance that can be made in heating apparatus design must be along the line of more efficient utilization of the heat. It has been definitely shown that two heating elements exactly alike, operated in exactly similar irons, one subjected to heavy pressure in assembling and the other having the holding-down bolts tightened with an ordinary wrench, will operate under the same wattage, but the one to which pressure was applied will be at a very much lower temperature than the other, although both produce eventually the same temperature in the ironing faces. The difference in temperature is due to the poor thermal contact between the parts in the iron to which no pressure was applied. It is thus essential to secure good thermal contact if the temperature of the resistor element is to be kept low. The idea of good thermal contact is being applied successfully now in the design of water heaters, disk heaters, toasters and other small stoves.

For heating large volumes of water or other liquids the popular form of heater is constructed from flattened copper tubing, in which the flat resistor elements are assembled under pressure. One of the most successful applications of this type of heater is found in the water sterilizers for hospital service. Water in such cases is heated to a temperature corresponding to a steam pressure of 15 lb. per sq. in. One of the circulating heaters operated at 250 watts brings the water in a six-gallon sterilizer to 15 lb. pressure per sq. in. in one hour, after which an input of 688 watts maintains the pressure.

In the case of frying pans and chafing dishes, a thin flat resistor insulated with mica plates is placed in the bottom and between two separate pans and subjected to heavy pressure. In neither case is there any easily destructible part. The pan itself may be immersed in water and cleaned without fear of injury to the heater, since it is sealed watertight. In the coffee percolator use is made of an immersion type of resistor, in which the heat is concentrated on the small valve well, so that the percolation will begin with cold water in the vessel in less than 1.5 minutes from the time the energy is supplied. The consumption of this outfit is 350 watts.

Electric cooking in the home has begun to be at least not uncommon. The utility toaster stove, the chafing dish, coffee percolator, disk stove, tea kettle, frying pan, small water heaters and many other small devices are being manufactured and sold in constantly increasing quantities. The cost of operation is not found to be prohibitive, while the ease and safety of operation are features that appeal to every woman.

Mr. W. R. Collier, of Atlanta, said that the percentage of repairs on heating elements is comparatively low, and in almost every type of heating apparatus of first-class manufacture very little trouble is encountered in replacing the defective element. The greatest part of the repairs are to broken attaching jacks and broken attaching plugs and cords. It is a mistake to use porcelain attaching plugs on any type of heating apparatus. The average customer is careless in the use of the cord, and the result is that a great number of attaching plugs have to be replaced every year. They should be made of some indestructible material, such as molded mica or hard rubber. From the electrical standpoint the cord in use at present is excellent, but from the mechanical standpoint it is practically a failure. During the year 1910 the total cost of repairs on flatirons and other heating apparatus by the Georgia Railway & Electric Company amounted to only about $100. The question presents itself, therefore, as to whether or not it would be good policy for the company to repair free of cost electrical heating apparatus used by its customers, just as it does with lamps. This method would seem to be advantageous from the standpoint of keeping the apparatus in commission.

Mr. Thomas W. Peters, of Columbus, stated that the Columbus Electric Company has made arrangements whereby any heating device can be bought by a customer on long-term payments. Ninety per cent of the heating devices placed in service under these conditions are paid for finally. In the case of tailors who use large electric irons the energy is sold at motor-service rates. This arrangement has proved satisfactory, in view of the fact that the irons are not in use during the lighting load peak. Mr. Calendar, of the General Electric Company, Atlanta, called attention to the fact that the Athens Electric Railway Company follows the plan of making all repairs to flatirons free of charge. This plan has worked satisfactorily.

Mr. Warfield claimed that central stations have expended proportionately too much time in introducing flatirons instead of other devices. The flatiron increases the load on Tuesday, but has no effect on the load on other days of the week. The lowest point in the daily load is about 6 o'clock in the morning. For increasing the load at this time the baker's oven is particularly advantageous. Central stations would do well to sell energy for use in the baker's oven at from 2 to 6 o'clock in the morning at a very low rate. A baker's oven can be purchased at from $300 to $900.

Mr. G. K. Hutchins, of Columbus, called attention to the advantageous features of the fireless cooker, on account of the low cost of the apparatus and the small cost for the energy to operate it. Mr. E. C. Deal, of Augusta, remarked that the cords used with heating devices are far from perfection. With sixty-four electric irons used ten hours a day for five and one-half days a week, for about eight months in a year, 150 cords were required for renewals. The manufacturers could do more for themselves and for the central station, in the way of advancing the sale of heating irons, by improving the cord than in any other way. This result is of even more importance than reducing the cost of the iron.

In reply to a question by Mr. Deal, Mr. Warfield stated that the price of ranges varies from $50 to $125, according to the size and number of separate units employed. An electric range that will do practically everything that an ordinary range costing $42 can accomplish can be purchased for about $50, so that the price of the electric range may be considered not to be excessive, even at the present time.

A paper entitled "The Importance of Wave-Form to Central-Station Operation," by Mr. M. T. Morrison, of Atlanta, was read by Mr. W. R. Collier. The author outlined the methods that have been employed for analyzing emf waves of alternators and described briefly the disadvantageous effects produced when the wave-form departs considerably from the sinusoidal.

The following officers were elected for the coming year: Mr. William R. Collier, Georgia Railway & Electric Company, Atlanta, president; Mr. E. C. Deal, of the Augusta-Aiken Railway & Electric Corporation, vice-president; Messrs. R. P. Mayo, O. A. Farrar and M. L. Sperry, executive committee, and Mr. Thomas W. Peters, Columbus Railway Company, secretary and treasurer.

The social features of the convention included an informal reception given on Tuesday night at the Muscogee Club and a trip to Goat Rock on Wednesday afternoon. For this trip a special train was furnished by the Georgia Section of the N. E. L. A. A picnic lunch and other refreshments were furnished by the following manufacturing companies: General Electric Company, Westinghouse Electric & Manufacturing Company, Electric Storage Battery Company, Western Electric Company and the Allis-Chalmers Company. The Hardaway Contracting Company and the Stone & Webster Engineering Corporation were hosts upon the arrival of the members and guests at Goat Rock, where the dam and many points of interest were explained.

Convention of Association of Edison Illuminating Companies.

Following are abstracts of papers presented at the annual meeting of the Association of Edison Illuminating Companies held at Spring Lake, N. J., Sept. 19-21:

HIGH-POTENTIAL DISTURBANCES.

The report of this committee, of which Mr. P. Junkersfeld, of Chicago, is chairman, deals with its investigation on the following topics: Turbo-generators and reactors; oil circuit-breakers; series and shunt instrument transformers; fuses for shunt instrument transformers; relays; synchronizing recorder; aluminum-cell arresters for underground-cable systems; underground-cable systems supplying magnetite-arc lamps; underground-cable systems of 20,000 and higher volts; inspection and tests of apparatus and material.

The committee drew attention to the heating problems which manifest themselves in the ever-increasing size of turbo-generators. With the higher-voltage coils the difficulty of getting rid of the heat because of the thicker insulation is such that the rise in temperature of a 6600-volt generator may without danger be considerably greater than that of a 10,000-volt generator. This difficulty is reflected in a recent order for 20,000-kw units wound for 4500 volts instead of 9000 volts.

During the year definite progress has been made in connection with the use of reactors external to generators, in connection with busbars, and in the design of machines possessing sufficient total reactance within their own windings. Experience has been too limited to present any facts

as to the probable value of external coils from an operating viewpoint, but the general opinion seems to be that the total reactance of the circuit should be approximately 8 per cent. The conclusion is also reached that a generator should be built with the highest amount of internal reactance consistent with the best design of generator, considering especially temperature and voltage, and, where it is not sufficient, external reactance should be used in addition. Reactors in connection with busbars have been used to sectionalize powers of 50,000 kw, and while this method reduces slightly the efficiency of large stations the security gained thereby is believed to be sufficient reason for the practice. Where parallel operation is desired limiting reactors are inserted in the busbars between the various sections.

The principal advancement noted by the committee in oil circuit-breakers has been along the line of improved baffling within the oil pot, so as to prevent excessive pressure within the pot, as well as the expulsion of large quantities of oil. The committee suggests in the case of tank-type circuit-breakers that the leads be insulated with oiled linen where they pass through the porcelain insulators, so as to obtain an additional factor of safety. High-tension series instrument transformers still add their quota to the list of disturbances noted throughout the year, and the committee voices the need of an indestructible series instrument transformer.

The criticism made by the committee against shunt instrument transformers built for 4000 volts and over is directed to the arrangement of the terminal projecting above the transformer case. It is felt that a plug and socket arrangement, amply insulated to prevent contact from the outside, would be a great improvement.

As regards fuses for shunt instrument transformers, two types of inclosed form of fuses have been developed, one of which is inclosed in a long fiber tube and the other in a regular porcelain tube, but operating data from these are not available. Some improvements have also been made in the carbon tetrachloride fuses, as described by the committee last year. The experience of several of the principal companies indicates that high-tension fuses of the types previously used very frequently open, not because of any defect in the apparatus to be protected, but because of inherent weakness in the fuse itself. Fuses of the liquid type, it would appear, cause less trouble.

An account is given of a relay for which correct selective action is claimed. One element of this relay, which is normally shunted, consists of a series motor so designed that the field will be saturated at a current corresponding to a definite overload on the series transformers to which the motor is connected. Up to saturation the speed of the motor is dependent upon the amount of overload, but beyond that point the speed of action is fixed. The distance of travel of the contact arm of the various relays is adjusted so as to be greatest at the switch within the generating station. Should a short-circuit occur on the line, therefore, all of the motors would be saturated, and the relay nearest the fault, having a shorter time interval than those between it and the station, throws the proper switch, causing all of the other relays to drop back into normal position immediately.

Space is also given in the report to a discussion of the synchronizing recorder, in which small holes are burnt in a thin sheet of special paper placed over the face of the indicator, the holes indicating the exact position of the instrument needle at the time the control switch and also the oil switch were closed. The purpose of the instrument is to give a tell-tale record of the exact position of the indicator needle when the generators are thrown in parallel.

Considerable diminution of trouble has been effected by equipping cable systems and busbars with aluminum-cell arresters, although the committee emphasizes the necessity of careful maintenance where aluminum arresters are used. When charging aluminum-cell arresters the induction from the line oftentimes disturbs adjacent telephone lines. An insufficient development of a film at the time of charging also causes potential rises sufficient to discharge lightning arresters on the low-voltage side of transformers. This latter occurrence may be avoided by charging the cells individually from low pressure and building up the film formation so that it can be charged in the regular manner. Fluctuations in the current taken by magnetite lamps, as compared with ordinary direct-current lamps, indicate that underground cable used in connection with magnetite lamps may be subjected to higher voltage variations. In order to avoid this one company uses a form of static device, the purpose of which is to discharge the circuit at intervals to relieve it of any static charge.

During the past year two comparatively large cable systems of 20,000 volts have been installed, on which joint and cable troubles have been noted. Experience indicates that the break-downs are much more frequent during the hot summer months, due, it is believed, to the drainage of the compound with which the paper is impregnated. The committee is of the opinion that there is room for improvement in American cable-manufacturing methods and cites the case of a Berlin company which has placed an order for 157 miles of paper-insulated cable for operation at 30,000 volts as an instance of the greater progress made abroad in cable manufacture.

Under the caption of inspection and tests of apparatus and materials the committee urges the need for more thoroughness, particularly in the production of apparatus and material, and recommends that every reasonable effort be made to effect proper inspection of material and proper factory tests before shipment.

The report of which the above is a brief abstract was the sole topic of Wednesday evening's session and drew forth what was said to be the best discussion ever presented before a technical society. The points discussed had to do with many untried problems and difficulties with which the large companies are now confronted, and so interesting were the facts and suggestions brought out that it was midnight before the session was brought to a close.

STEAM TURBINES.

The steam-turbine committee reported no new developments, but emphasized the need of manufacturers considering details of design as affecting the time needed for making repairs. No radical changes have been made in condenser practice either, but attention is called to the fact that oil systems should be most carefully protected by inclosing the main supply and filter tanks by brick walls separating them from the main operating rooms. No sources of ignition, such as gas jets, motors with commutators, etc., should be permitted in proximity to the oil-piping system, because the danger from escaping oil has been shown to be serious. The recording and indicating Pitot-tube type of steam-flow meters built by the General Electric Company were described and their usefulness for daily observations of boiler-house conditions was pointed out at length. Appended to the report were notes by the General Electric Company, the Westinghouse Machine Company and the Westinghouse Electric & Manufacturing Company, outlining improvements in construction made in both the steam turbine and the generators. The General Electric Company has built six-stage vertical turbines of 15,000-kw and 20,000-kw ratings and two standard horizontal units of 7500-kw and 4000-kw ratings. It has also developed a three-stage 1500-kw machine. High-speed generators for turbines are now built with solid forged rotors, but the General Electric Company no longer sanctions the use of high-voltage windings on high-speed machines, recommending instead windings of moderate voltages in connection with transformers or auto-transformers. The Westinghouse company has in contemplation turbines of 30,000-kw rating, and is also at work on

turbines of 200-kw rating and under; for mixed lighting and heating loads automatic bleeder turbines have been devised. Where, after long service, undue erosion of the walls of a turbine has taken place brass liners have been inserted to advantage. The electric company points out the advantages of the radial slot and of the parallel slot in rotors of turbo-generators, claiming that the latter is better adapted for high-speed machines, while the radial slot is better for slow-speed machines. The company builds its large turbo-generators with sufficient internal reactance to limit the instantaneous short-circuit current to less than fourteen times normal current, the limit indicated by tests and experience to be safe. A test of a 7500-kw machine driven by a water-wheel showed a maximum instantaneous current only eight times normal rated current. The company points out that damage to windings depends on the duration and number of short-circuits, as well as on the short-circuit current.

PROGRESS IN TRANSMISSION OF ELECTRICAL ENERGY.

A paper, the full title of which was "What the Central Stations Can Gain from the Latest Progress in Electric-Power Transmission," was prepared by Mr. Philip Torchio, of the New York Edison Company, and read in his absence by Mr. Lieb. A comprehensive review of the commercial and economical features, as well as constructive details and operating experience, is given in a report presented simultaneously by the author at the International Congress of Applications of Electricity in Turin, at which Mr. Torchio represents the Association of Edison Illuminating Companies. The report deals extensively with hydroelectric transmissions and calls attention to operating records which show remarkably good reliability of service for the extra-high-tension systems. This is probably owing, among other reasons, to the fact that the extra-high-tension lines are operated as main trunk lines with few and well-designed receiving substations in constant charge of expert operators. The report also shows that the cost of equipment for these substations is relatively small if the energy received is large, but prohibitively high if the installation is small. These considerations point out the fact that for best all-around economy the hydroelectric transmitting systems on the one hand and local central stations on the other, at least as far as operation is concerned, should be correlated in one system in order to take full advantage of the respective economies of cheap primary energy and economical distribution. It is evident that local central stations by becoming the sole distributors of energy for all services in a given district would be in a position to realize enormous savings both in investment of substations and distributing lines and in the cost of operation and maintenance, as well as in general expenses and management. Furthermore, from a commercial standpoint the co-operation of these central stations, with their reserve steam plants and skilful operating forces always available, would enhance the value and improve the service of the hydroelectric transmissions. In the light of the information contained in the report, the author reviews the possibilities of interchanging steam-power between distant systems for the purpose of regulating the operation of the less efficient plants for emergency and peak loads. Considering from the commercial aspects the possibilities of long-distance energy trunk lines, the author says that in the territory traversed by the lines there may be a number of adjoining towns, manufacturing centers, railroads, local street and interurban railways and lighting central stations. An interconnection between these smaller central-station plants and the main trunk line would give to each small central station the same facilities that are enjoyed by the larger ones in dealing with large customers and service requirements of all kinds. In dealing, for instance, with enterprises like railroads operating through territories of different companies the advantages of being able to make a common contract are very apparent. From the appreciation of these mutual advantages and the incidental operating and investment economies derived from the joint operation of common trunk energy lines it would appear that the latest progress in extra-high-tension transmission opens the avenue for the central station to enter into a great new field of expansion. This growth would also benefit the public largely, as it will make feasible industrial developments of great economic and sociological importance.

METERS.

Due to the expiration of certain of the Tesla basic patents last December, the induction-meter situation changed materially during the year and many new meters appeared on the market. The meter committee of the Edison association, therefore, directed its investigation to these new meters, and although the field is not yet an open one, pending the expiration of certain Shallenberger patents on Jan. 1, 1912, the situation, in the opinion of the committee, is very promising in the progress already made in the direction of a cheaper meter. These developments have applied wholly to induction meters. Descriptions of the meters investigated form part of the report. The greater part of the report, however, is given over to Section 9 of the meter code as presented by the meter committee of the N. E. L. A. at its last convention, supplementing which are additions to Sections 5 and 6, presented for the first time. The additions have to do with wiring protective devices for meters, location, choice and wiring of meters, installation devices, methods for verifying connections and rules, and precautions for meter installation work. With these additions the committee feels that the meter code is complete and may be accepted as standard for some time to come, pending such revision as may be necessary due to the test of time and changes in the art. It expresses gratification that the meter code has been adapted by public-service commissions.

ELECTRIC VEHICLES.

The report of the committee on electric vehicles indicates that great progress has been made in the introduction of this type of wagon and carriage during the past year. The committee, however, is firm in its belief that the great majority of central stations are not doing all they can to further the more rapid use of all classes of electrics in their respective territories and thus build up a highly profitable off-peak load. It has been reported to the committee that as of Sept. 1, 1911, users have invested $10,000,000 in electric trucks and $30,000,000 in electric pleasure vehicles and that the total yearly value of the energy needed to operate these cars properly, figured at 4 cents per kw-hour, amounts to $1,800,000.

The manufacturers advise that of the above total sales of electric vehicles to Sept. 1, 1911, not less than 1000 electric trucks at a value of $2,500,000 and 5000 electric pleasure vehicles at a value of $10,000,000 have been sold during one year ending Sept. 1, 1911. It is estimated that the value of the electricity necessary to charge the batteries of the vehicles sold during the one year will not be less than $420,000, on the basis of energy at 4 cents per kw-hour. The reports from the various electric-vehicle manufacturers also indicate a very large increase in business this year over any previous year, one manufacturer of commercial vehicles reporting more business done the first three months of this year than in the whole of last year. As indicative of the enormous possibilities for growth in this business the committee cites the twelve years' sales of all kinds of electric vehicles to Sept. 1, 1911, at $40,000,000, whereas for one year ended Sept. 1, 1911, a total of $12,500,000 of all types of electric vehicles was sold, indicating that 31.3 per cent of all the electric vehicles sold and in use to date were sold during the one year ended Sept. 1, 1911. This, the committee states, should cause all to consider very carefully whether everything that can be is being done to obtain this desirable new business.

Convention of Kansas Electric Association.

Following are abstracts of the papers presented at the final sessions of the Kansas Electrical Association, which held its fourteenth annual meeting at Independence, Kan., Thursday and Friday, Sept. 21 and 22.

POWER INSTALLATIONS.

Friday morning's program was opened by Mr. W. T. Dean, of the General Electric Company, Chicago, who exhibited and explained a number of lantern slides illustrating standard and special applications of electric-motor drive and new types of motors.

Prof. C. I. Corp, of the University of Kansas, at Lawrence, followed with a paper on the "Effect of Size of Units on Cost of Power." As an example Professor Corp had investigated the relative efficiencies of several different kinds of motive power for operating a pump in a brewery where a 160-hp engine-driven generator plant was already installed, although this unit would have been only one-fourth loaded by the pump. In his conclusions the speaker found that while the old plant would have an absolute theoretical efficiency of 1.67 per cent, based on the heat units in the coal, a motor-driven pump would show an efficiency of 6.61 per cent and a steam pump 9.35 per cent, indicating the last, in this case, as the desirable means of drive.

APPRAISALS, ETC.

"The Value of Public Utilities" was the title of a paper by Mr. Clinton S. Burns, of Kansas City, Mo. After discussing the importance of proper and correct appraisals of public-utility properties in establishing bases for rates, taxes, etc., Mr. Burns entered upon a discussion of "franchise values," "going values" and other of the recently developed conceptions which must be taken into account by the appraiser in determining the intangible values that, in addition to the physical plant, make up the actual value of an operating utility.

Prof. C. A. Johnson, of the university staff at Lawrence, followed with his paper on "Some Factors in Electric Lighting." In discussing the effect of too intensely illuminated surfaces in the field of view the speaker made the point that, after its millions of years of evolution, the retina of the eye, while becoming accustomed to a brightly lighted upper field like the sky, is yet very sensitive to high intensities in the lower half of the picture. This fact, he said, is evidenced by the tendency to snowblindness and should receive consideration in any artificial lighting scheme. Professor Johnson also referred to the harmful effects of ultra-violet rays, flickering light sources, visible and glaring light sources in the field of view, etc. In planning illumination of interiors he directed attention to the sense of "warmth" given by certain colors and the necessity for a certain amount of shadows while obtaining a "soft" lighting effect.

WIRES AND LINE CONSTRUCTION.

Mr. L. G. Martin, of the Okonite Company, New York, spoke next on the subject of "Better Insulation." Referring to the new rules of the Board of Underwriters, he suggested that these might well have been even more drastic and outlined a series of tests to determine both the chemical and mechanical properties of the rubber insulation used on wires, in addition to the electrical resistance offered by the material. Mr. Martin advocated the rigid subjection of samples of all insulated wire used to the tests which he described.

Mr. W. H. Pennell, chief engineer of the Missouri & Kansas Telephone Company, Kansas City, read a paper on the joint use of poles by telephone and electric-light companies, following the new specifications that have been issued by the American Bell company for such joint-pole construction. The speaker enumerated the economy and advantages of the joint construction, which separates the telephone and lighting wires a distance of 6 ft., ample to prevent induction or danger of crosses. The specified construction requires a pole only 5 ft. higher than that needed for single duty. In many places it has become the policy for the telephone and central-station interests to bear jointly the building of new pole lines, although only one may have immediate use for the poles.

Mr. L. O. Ripley, of Wichita, closed the central-station program with a brief discussion of the difficulty of getting some employees to handle customers tactfully, as well as the difficulty with which some customers are handled.

ELECTION OF OFFICERS.

The convention committees appointed by President Murrow at the opening meeting were as follows:

Nominating Committee—Messrs. A. L. Newman, Arkansas City; C. H. Talmadge, Kansas City, Mo.; C. H. Rathert, Junction City.

Auditing Committee—Messrs. W. S. Newman, Kansas City, Mo.; W. H. Fellows; H. W. McGruder, Liberal.

Resolutions Committee—Messrs. M. T. Flynn, Kansas City; A. G. Purdy, Topeka; G. A. Seabury, Kansas City, Mo.

Committee on 1912 Convention—Messrs. L. O. Ripley, Wichita; C. C. Brown; B. F. Eyer, Manhattan.

The report of the nominating committee selecting association officers for the following year met the unanimous approval of the convention and the following were declared elected:

President, Mr. B. F. Eyer, Manhattan; first vice-president, Mr. J. H. Rathert, Junction City; second vice-president, Mr. W. J. Welfert, Winfield; third vice-president, Mr. M. T. Flynn, Kansas City; secretary-treasurer, Mr. J. D. Nicholson, Newton. Executive committee, Messrs. L. O. Ripley, Wichita, chairman; A. G. Purdy, Topeka, and W. E. Sweezey, Junction City.

PRESIDENT-ELECT B. F. EYER.

Prof. B. F. Eyer, the president-elect of the Kansas association, is professor of electrical engineering at the Kansas Agricultural College, Manhattan, and is also vice-president of the local central-station company. Professor Eyer attended both the University of Chicago and the Armour Institute of Technology, being graduated from the latter in 1902, and has since received his E.E. degree. Besides instructional work at the university and the care of his own private electrical interests in the Manhattan company, Professor Eyer has devoted some time to consulting work for a number of the smaller Kansas central stations. He is a member of the National Electric Light Association and is an associate of the American Institute of Electrical Engineers.

On invitation of President-elect Eyer the 1912 convention of the Kansas Association will be held at Manhattan at a date in the fall yet to be determined upon.

Convention of Northwest Electric Association.

Following are abstracts of the papers and discussions at the final sessions of the Northwest Electric Association, which held its annual convention at Tacoma, Wash., Sept. 21-23.

Friday's session began with the reading of the paper of Mr. Arthur Gunn, Wenatchee, Wash., on "New-Business Methods for the Small Central Stations."

CENTRAL-STATION NEW-BUSINESS METHODS.

In this paper the author outlined the characteristics which should be possessed by the managers of small plants if they are to be successful. The characteristics mentioned include ambition, intelligence, information, industry, tact, perseverance, courage, common sense and a feeling of dissatisfaction with what he is and what he has accomplished. It is essential for him to lend his energies to giving a satisfactory service. His motto should be "Charge what the service is worth and deliver all that the customer pays for." He should seek to give the customer that type of installation from which he will get the largest business return for his money.

Suggestions relating to methods of accounting to be employed in connection with national and state legislation were briefly outlined in a paper by Mr. C. M. Huggins. The author stated that there has been a great change in the attitude of corporations toward commissions during the last two or three years, and it is now appreciated that while there may be considerable annoyance in complying with the numerous demands made by the commissions and considerable extra expense is entailed in doing so, yet much benefit has been derived from their oversight. The time is rapidly approaching when investors will be very chary indeed of securities of public-utility companies which are not under commission regulation. Although absolutely uniform classification of accounts for all operating companies would not be desirable on account of differences in local conditions, yet the corporations should adopt such reasonable forms, with the fewest possible complications, as will most readily furnish information desired by the various commissions.

Discussion.

In a discussion Mr. Fred Shields, Moscow, Idaho, laid stress on the fact that the fixing of rates in small central stations was a different problem from that confronting larger stations, as it was not as easy to explain a complicated rate schedule to the small municipalities as to the larger cities.

The matter of the extension of lines to outlying districts was also discussed and different experiences were narrated. A number of interesting cases of the methods employed for securing new business in small towns were outlined by several speakers.

At this point Mr. McMicken, Portland, Ore., in behalf of the Pacific Light & Power Company, the Portland Gas & Electric Company and the Byllesby Company, invited the Association to hold its next annual convention in Portland, Ore.

The paper of Mr. C. N. Huggins, Portland, Ore., entitled "Methods of Accounting in Connection with National and State Legislation," was next presented.

In the discussion that followed it was stongly urged that a uniform system of accounting should be adopted; it was also urged that a valuation of water powers should be established.

The next paper to be read was entitled "Central-Station Problems," and was prepared by Mr. A. C. McMicken, Portland, Ore.

CENTRAL-STATION COMMERCIAL PROBLEMS.

The author discussed the several competitors of electricity. He stated that in some of the cities gas competition represents the most serious problem. Gas at $1 per 1000 cu. ft. represents serious competition among certain classes of customers. However, a 250-watt tungsten-lamp equipment can compete successfully with the so-called gas arc, both in illumination and in the cost of operation at the commercial rates charged in the larger cities. In the line of cooking, energy at 3 cents per kilowatt-hour is equivalent to gas at $1 per 1000 cu. ft. Although much of the operation of the electric range occurs during off-peak hours, yet the fact remains that some of the load does overlap the peak. It is therefore questionable whether electric cooking at the low rate necessary to compete with gas represents profitable business for the average central station company to solicit.

The most serious competitor with the electric motor in the Pacific Coast cities is the oil-burning isolated manufacturing plant. With oil fuel, which can be purchased at from 70 cents to $1.25 per gallon, certain isolated plants are producing energy at as low as $30 per hp-year. It has been shown in a number of instances that the manufacturer is willing to pay a little higher cost per year for electricity, provided the output of his factory can be increased by the installation of motors, the reduction of friction losses usually accomplishing the desired results. Although the rapid adoption of small high-efficiency lamps by residence consumers has been a source of worry to certain central-station managers, the fact is that the high-efficiency lamp, generally speaking, has been a boon to the central station, making it possible to secure much business which could not formerly be obtained and educating the public to the use of more light.

Discussion.

Discussion of this paper was taken up at the afternoon session. A question arose as to the advisability of extending lines where a certain revenue was not guaranteed. In the larger cities it was deemed advisable to endeavor to reach all consumers, even though a given income is not in sight, inasmuch as the franchise practically entitles the people to the service if desired; whereas in the small towns and outlying districts it perhaps would be wiser to extend lines only where a given income could be realized. It was pointed out that the tendency not to build to prospective consumers in the cities tended to create a feeling for municipal ownership.

Mr. T. C. Martin, secretary of the National Electric Light Association, was introduced to the convention at the morning session, and explained the advantages to be gained by affiliation with the national association. He assured the association that it would in no way lose its identity or state rights, and would be greatly benefited by the assistance received from the national association in matters of pernicious legislation, etc., and the distribution of valuable literature. He showed where other minor associations had benefited to a great extent by such affiliation, and urged a like action on the part of the Northwestern association. The matter was referred to the executive committee for action.

Mr. S. E. Doane, of the National Electric Lamp Association, was then introduced, and addressed the convention on the lamp situation, stating that it was only a matter of time when tungsten-filament lamps would universally take the place of carbon-filament lamps, and showing where this would be of benefit both to the central station and the consumer. He stated that these lamps would be supplied in low wattages within a short time, and also dwelt on the value of the rate committee and its work.

The first paper at the afternoon session was that of Mr. R. E. Thatcher, Seattle, on "Meter Accuracy in Relation to Central-Station Income."

METERS AND CENTRAL-STATION INCOME.

Mr. R. E. Thatcher presented a paper in which attention was called to the importance of meter accuracy with relation to central-station income. He stated that the energy at the meter is the finished product, and anything affecting the registration of the energy affects the gross income, so that a saving as small as 2 per cent in the gross income may determine whether dividends will be paid or not. The watt-hour meter is an instrument having an inherent tendency to under-register the energy passing through it. As a general proposition an average increase of from 1 per cent to 1.5 per cent in the accuracy of meters will more than pay the cost of making tests. Mr. Thatcher stated that the results obtained with cupped-diamond jewels in direct-current meters have been highly satisfactory, the life being about five times that of the sapphire jewel. The flat diamond with a ring-stone sapphire guide has not proved satisfactory. In making periodic tests of meters it is desirable to use a phantom load. One of the most convenient methods is that involving the use of small storage batteries for supplying current to the series coils. Very satisfactory results have been obtained with portable automobile batteries rated at 60 amp-hours. Phantom loads for alternating-current meters can easily be obtained by means of series transformers. A convenient lamp-bank load for use in testing small meters consists of twelve 32-cp and two 16-cp tubular lamps placed in a wooden carrying frame, upon which are located the controlling circuits. The lamps are so arranged that they may be connected two in series across 220 volts, or all in parallel across 110 volts.

Following Mr. Thatcher's paper, Mr. J. G. Finley, Spokane, read a very exhaustive treatise on the conditions obtaining with the different companies in this regard.

Mr. H. M. Winter, Seattle, then read his paper on "Electric Heating and Kindred Uses of Electricity."

ELECTRIC HEATING.

Domestic and commercial electric heating and cooking, domestic electric heating and the domestic application of motors were interestingly described in this paper. Among the heating devices the flatiron was said to be the greatest revenue producer, the average monthly consumption being about 6 kw-hours. Second to the flatiron among the heating and cooking devices is the toaster, which consumes 650 watts or less. The average monthly consumption of the toaster is approximately 3 kw-hours. On account of the high initial cost of electric heating and cooking appliances, in the majority of homes individual articles, such as hot plates, broilers, frying pans, cereal cookers, grids, etc., are purchased from time to time, the expectation being thereby to acquire finally a complete set. The average connected load with the large kitchen outfits is approximately 5 kw. Where the connected load is approximately 5 kw the average kilowatt-hours used per month is about 150. Many of the central-station managers have expressed themselves as being of the opinion that until the manufacturers develop an electric range with a lower maximum demand than can be obtained at present it will not be wise to advocate the use of electric cooking exclusively in the home.

Mr. Cheney, of Seattle, one of the staff of the Washington Underwriters, was then introduced, and addressed the meeting on the necessity of all wiring in small towns, without inspector service, being done with the utmost care, to eliminate fire risk. He stated that endeavors were being made to have the agents of the different light companies in these small towns appointed inspectors, to see that all electrical work was properly done.

The executive committee, after discussing the proposition of the Northwestern association affiliating with the National association, recommended such affiliations.

At the meeting on Saturday, Sept. 23, a paper by Mr. N. W. Brockett, Seattle, entitled "Legal Aspects of the Light and Power Business," was read and discussed. The subject was treated under the heads of organization, water-rights, business organization, franchises, right-of-way, protection of lines, contracts, collections and liability. Each of these was handled in an instructive manner. In appendices were outlined decisions on water rights in Washington and petitions for franchises.

The final paper of the convention was one presented by title dealing with municipal ownership.

MUNICIPAL OWNERSHIP.

In a report prepared for the taxation committee of the Seattle Chamber of Commerce much information was given concerning the municipal ownership and operation of the central station in Seattle. According to the report the city lighting plant is charging and collecting from the taxpayers through the general fund an average of $181 per kilowatt-year for street lighting, while private consumers are obtaining service at from $40 per kilowatt-year to $80 per kilowatt-year. The plant is charging and collecting from the taxpayers through the general fund an average of 4.62 cents per kilowatt-hour for street lighting, while private consumers obtain rates as low as 1.5 cents per kilowatt-hour. The report claims that electric lighting and motor service is being furnished to the private consumers at less than cost of manufacture and distribution when all the elements of expense are considered.

PRESIDENT-ELECT J. E. DAVIDSON.

Instead of the more usual "question box" certain of the members prepared questions which were answered in a formal manner by other members. Messrs. C. H. Cleaver and Arthur Gunn submitted in this way questions relating to supplying energy in small quantities for general domestic service and in larger quantities for railway service, which were answered by Messrs. H. V. Gates and R. A. Willson.

AFFILIATION WITH N. E. L. A.

As a result of a recommendation to the executive committee the following resolution was unanimously adopted:

"That the report of the executive committee on the question of affiliation with the National Electric Light Association be and the same is hereby approved and ratified with the understanding that the present autonomy of the Northwest Electric Light & Power Association be retained, and the power of collection of dues and other funds be fully retained by this association, the secretary of this association to remit to the National Electric Light Association an amount not exceeding one-half of the fees now charged by the national association, as such amounts may become due; this resolution to take effect Oct. 1, 1911."

Changes were made in the constitution so that hereafter Class A and Class B members will not have to pay an

initiation fee, the annual fee of Class B and Class C members will be $5, and the president cannot be re-elected to serve for two years after his expiring term.

The president and secretary were instructed to make formal application covering the affiliation of the Northwest Electric Light & Power Association with the National Electric Light Association.

A motion that the constitution of the N. W. E. L. & P. A. be amended so as to conform in all details with the requirements of the N. E. L. A., and that the inserting of the necessary clauses into the constitution be left in the hands of the committee on amendments, its powers to be limited to the resolution already adopted, was promptly voted down.

The following officers were unanimously elected: Mr. J. E. Davidson, Pacific Light & Power Company, Portland, Ore., president; Mr. J. M. Kincaid, Port Townsend, Wash., first vice-president for Washington; Mr. George Harding, Coeur d'Alene, Idaho, second vice-president for Idaho; Messrs. H. L. Bleecker, Spokane, Wash.; W. J. Grambs, Seattle, Wash.; Arthur Gunn, Wenatchee, Wash.; O. B. Coldwell, Portland, Ore.; M. D. Spencer, Eugene, Ore.; L. B. Faulkner, Olympia, Wash.; J. S. Thronton, Aberdeen, Wash.; Douglass Almond, Anacortes, Wash., executive committee. Mr. Norman W. Brockett was appointed by President Davidson as secretary-treasurer to succeed himself.

ENTERTAINMENT FEATURES.

On Thursday afternoon, Sept. 21, the visiting ladies were the guests of the Washington Water Power Company on an automobile trip to the Spokane Country Club. Tea was served at the club house, and a pleasant social afternoon was spent, the party returning to Spokane in the evening. At 8:30 in the evening an informal ball was held at the Hall of Doges. Seventy-five couples attended this function. At 11:30 lunch was served in the "Hall of Palms." The affair was admirably handled and an atmosphere of welcome and hearty fellowship pervaded the hall.

On Friday morning the ladies at the convention were the guests of the Spokane-Inland Railway Company on an excursion to Hayden Lake. About forty ladies attended the function and dinner was served at the lake.

Friday evening was given over to the viewing of Spokane by electric light, and all members expressed great surprise at the modern, up-to-date illumination of the city, the number of display windows and signs and the substantial, high-class character of the signs as well as the lack of gas installations.

On Saturday afternoon the visiting guests were entertained by the Washington Water Power Company on an automobile sight-seeing excursion throughout the city. About fifty availed themselves of this opportunity.

On Saturday evening the closing banquet was held at Davenport's Restaurant, about 125 members being present. The lady visitors attended a theater party in a body as the guests of the Washington Water Power Company.

On Sunday seventy-five members were taken on an automobile inspection trip to the Long Lake and Little Falls plants of the Washington Water Power Company.

Public Service Commission News.

WISCONSIN COMMISSION.

The Milwaukee Electric Railway & Light Company has been authorized by the Railway Commission to issue $2,000,000 of refunding and extension mortgage bonds, in denominations of $1,000 each, to bear interest at the rate of 4½ per cent per annum. The issue is authorized for the purpose of supplying the company with funds to pay an outstanding indebtedness incurred by reason of additions and extensions made to the property during the year ended Aug. 1, 1911. The bonds must be sold for money and for not less than 85 per cent of par value. The mortgage deed has been made by the company to the Trust Company of America and W. H. Leupp as trustees.

The commission recently heard the arguments on the petition of the Manitowoc & Northern Traction Company for authority to increase its fare between Manitowoc and Two Rivers from 10 to 15 cents. The company's charter provides for a 10-cent fare, but the traction company contends that this rate does not yield a sufficient revenue to pay all legitimate expenses. The company recently won its case in court, but upon suggestion of the court the commission was asked to investigate the conditions and fix the amount of the fare.

MARYLAND COMMISSION.

The Hagerstown Railway Company has petitioned for permission to purchase 267 shares, at $50 per share, of the Myersville & Catoctin Railway Company. This purchase, if allowed, will transfer control to the Hagerstown Railway Company and will be an additional step in the consolidations which have lately occurred in the interurban lines of western Maryland.

A public hearing on the proposed new rates of the Chesapeake & Potomac Telephone Company will be given Oct. 18, beginning at 10:30 a. m. At the same time the commission will consider the report of Messrs. D. C. and W. B. Jackson, the Boston experts, on the proposed rates, which was recently submitted to that body and printed in pamphlet form by the commission. The new rates were submitted to the commission several months ago and it made many changes, including the abolition of flat-rate unlimited service. Some of the changes are reductions, while others are apparently increases. The subject is so complicated that the commission secured the services of the experts, who took up the questions involved with Charles E. Phelps, Jr., the chief engineer of the commission. The Messrs. Jackson recommend the adoption of the new schedule with some minor changes.

NEW YORK COMMISSION NEWS.

On Oct. 16 the Public Service Commission for the First District will consider the petition filed by various organizations of stationary engineers against the rates now charged by the New York Edison Company. It was alleged in this petition that the rates charged to small consumers are exorbitant as compared to those charged to large ones.

An application has been received from the Dry Dock, East Broadway & Battery Railroad Company for authority to change from the use of horse cars to storage-battery cars on its Avenue B and Canal Street lines. The company is a part of the Third Avenue system, now operated through receivership. A hearing is scheduled for Oct. 13.

A hearing has been ordered to be held on the application of the New York & North Shore Railroad Company for authority to issue bonds to the amount of $1,500,000 and stock to the amount of $771,764, proceeds of which are to be used for improvements. Mr. Edward M. Bassett, formerly a member of the commission, represents the road in the application.

OHIO COMMISSION NEWS.

Two applications for exchange service between Independent and Bell Telephone Companies and two applications for the sale of Bell properties to Independents have been filed with the Public Service Commission at Columbus. In the cases of the latter supplemental petitions asking for the exchange of service were also filed. The hearings were set for Oct. 6.

The applications for exchange of service were made by the Mount Sterling Telephone Company and the Van Wert Telephone Company, while President B. E. Sunny and Secretary C. E. Mosly, of the Central Union, signed for that company. The contracts submitted for approval provide

that the local companies shall receive 25 per cent of the long-distance tolls originating on their lines, or if they establish branch switchboards, then they are to receive 60 per cent of the tolls. The Bell company is to pay the taxes on the long-distance lines, but the local companies may rent its instruments at the rate of $1 per year, delivered at Indianapolis. According to the contracts, the Central Union has reserved a measure of control over the local companies, as they will not be permitted to make any switchboard or other connections with any other lines without the written consent of this company. On the other hand, decisions of the federal court, rendered some years ago, were to the effect that local companies are under obligations in giving public service to afford connections with other lines that apply for them and cannot limit themselves to connections with the lines of one long-distance company exclusively unless no requests for connections are made.

Applications for the sale of Central Union properties to local Independent companies were received from the Citizens' Telephone Company, of Delaware, and the Ashtabula Telephone Company, of Ashtabula. In the petitions it is stated that duplication of service either results in rendering the business unprofitable to the companies or imposes an undue burden upon the public.

The value of the Central Union property at Delaware is placed at $10,573, which the Citizens' Telephone Company says it is willing to pay. At Ashtabula the value of the Central Union property is given as $17,950, with the addition of $1,450 for toll lines in Ashtabula County. There the saving to users is placed at $2,448 per year.

Opposition has developed to the merging of the plants at Delaware and Ashtabula. Those who have made complaint claim that the step will result in an increase in the rates for service so far as the public is concerned. Under the circumstances the commission will be compelled to make a rigid investigation in both cases to ascertain for itself the probable results of consolidation.

The commission has received a written complaint from Mayor Baehr, of Cleveland, alleging that the service given by the Cleveland Telephone Company and the Cuyahoga Telephone Company is inefficient.

This step was taken by Mayor Baehr following the adoption of a resolution by the City Council requesting him to file complaint. The resolution was offered by Councilman Townes because of numerous complaints made by merchants on West Twenty-fifth Street and was adopted by unanimous vote of the members. The matter had been under discussion for some time and councilmen had investigated to some extent before the resolution came before them.

Another resolution prepared by Councilman Townes authorizes the city clerk to insist that Cuyahoga County delegates to the constitutional convention make an effort to secure an amendment that will authorize the cities to own and operate telephone systems in competition with the privately owned plants. This was brought about through the belief that a material advance in rates will be made when the two local companies are consolidated, as it is expected they will be. Council has the advice of a telephone engineer to the effect that a plant with a capacity for 25,000 telephones can be installed complete, buildings and underground work, for the outlay of $3,500,000. The Cleveland Telephone Company now claims 40,000 subscribers, so it would seem that a plant of the size under consideration would not be sufficient to take care of the business if the rates fixed are sufficient to take a great amount of business from the two old companies, even when combined.

Secretary Radcliffe, of the Public Service Commission, has rendered an opinion to the effect that telephone companies may increase their rates without consulting the commission, but that they must file their schedules with it. Then, upon complaint or upon its own initiative, the commission may make an investigation and afford relief if it finds that the rates are excessive. It was the general opinion that the new law made it impossible to increase rates until some further legislation was secured along that line.

The report of the Cuyahoga Telephone Company, of Cleveland, filed with the commission, shows that it is furnishing service in about seventy-five instances free of cost. These are given under the head of "Schedule of Special Contracts." The commission will look into the nature of these contracts. The only free or reduced-rate service allowed under the new laws is to the United States government, the State, county, city and charitable institutions and to officers and employees of the company.

Assistant City Solicitor A. J. Dwyer, of Dayton, has rendered an opinion that the telephone companies of that city may continue to furnish service to the public schools at special or reduced rates. He states that the boards of education are subdivisions of the State and that the new public-utilities law provides for this. The schools are now paying $350 per year for their service, while the cost would be about $3,000 if the full rates were paid.

ONTARIO HYDROELECTRIC COMMISSION.

The Lindsay Light, Heat & Power Company, which prior to Sept. 29 had no franchise, decided to sell its entire plant and system. The town secured an option on the plant, and a valuation of $230,000 was placed upon it by the Ontario Hydroelectric Commission. In the meantime the Seymour Power Company came forward with a somewhat higher offer to the Lindsay Light, Heat & Power Company than the town had made and also offered very favorable terms to the town corporation of Lindsay in exchange for the granting of the franchise. On Sept. 29 the ratepayers carried a by-law granting a franchise to the Lindsay Light, Heat & Power Company, but the passing of this by-law by the ratepayers does not in any way preclude them from voting on the by-law to be submitted on Oct. 12 providing for the purchase of the Lindsay Light, Heat & Power Company's plant by the town. The passing of the first by-law has occasioned considerable comment in the town, as in the event of the defeat of the by-law on Oct. 12 the Seymour Power Company will secure possession of the Lindsay Light, Heat & Power Company and, with it, the franchise granted to the latter company by the ratepayers on Sept. 29.

CURRENT NEWS AND NOTES.

Colorado Electric Club.—At the midweek lunch on Sept. 28 of the Colorado Electric Club Mr. J. C. Hendricks, manager of the Denver baseball team, explained how the Jovian method of "altogether all the time" had been successfully applied to his team and had secured to it the pennant by the largest percentage margin of any league in the country.

* * *

Rockford (Ill.) Electric Show.—The armory at Rockford, Ill., has been secured for an electric show and the business sessions of the Illinois State Electric Association, which will hold its annual meeting Oct. 24, 25 and 26 in Rockford. Among the speakers will be Mr. H. E. Chubbuck, general manager and executive officer of the Illinois Traction System; Mr. John C. Gilchrist, president of the National Electric Light Association; Mr. W. A. Fox, of the Commonwealth-Edison Company, and Mr. Frank Baker, of the North Shore Electric Company.

* * *

Census of Electric Meters in Second Commission District, New York.—The New York Public Service Commission, Second District, has made a census recently of the total number of watt-hour meters in service in the district. Returns were received from 297 companies, which showed a total of 162,488 meters in use as of July 1, 1911.

A few companies which operated a small number of meters did not report in time to have their records included in the census, but it is estimated that the addition of the meters of these companies would increase the total to 165,000 meters. This amount includes, of course, all of New York State, excepting Greater New York, which is under the jurisdiction of the First District commission. If the average investment per meter, including installation expense, is assumed at $18, which is probably a low estimate, this would mean a total investment in recording watt-hour meters of nearly $3,000,000 in the Second Public Service District.

* * *

Dr. Steinmetz's Annual Lecture in Chicago.—A lecture by Dr. C. P. Steinmetz, of Schenectady, has become a regular annual feature of the joint meetings of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers. This year Dr. Steinmetz's subject will be "Reactance in Alternating-Current Circuits," and he will speak on the evening of Oct. 25, probably at Fullerton Hall, Art Institute.

* * *

Value of Electric-Sign Advertising.—It is stated that the electric-sign space on the roof of the Studebaker Building, covering half a block above Forty-eighth Street, between Broadway and Seventh Avenue, New York, has been leased at a price close to $25,000 a year. The conditions of the sign lease imply that the roof cannot be used for any other purpose. The new sign, which will cast its blaze of light down Broadway and Seventh Avenue, in the theater district, will proclaim the virtues of a breakfast food.

* * *

A Better Sign Ordinance Urged for St. Louis.—The need for more liberal provisions in the St. Louis electric-sign ordinance, which now restricts displays to positions within 18 in. of buildings, was urged in a talk by Mr. Ell C. Bennett, of St. Louis, before the St. Louis League of Electrical Interests, on Sept. 26. The speaker declared that spectacular electric signs, brilliantly lighted streets and brightly illuminated store windows attract visitors and serve as a stimulus to trade. The enactment of a better sign ordinance, said Mr. Bennett, should be the first work of the business organizations of the city.

* * *

American Society of Municipal Improvements.—The eighteenth annual convention of the American Society of Municipal Improvements was held in Grand Rapids, Mich., on Sept. 26 to 29 inclusive. Such subjects as garbage disposal, street cleaning, paving, sewer specifications, water supply, etc., were discussed. Mr. E. A. Fisher, city engineer of Rochester, N. Y., delivered the report on street lighting, and Mr. Joseph E. Putnam, assistant city engineer of the same city, read a paper entitled "Some Examples of Ornamental Street Lighting." Mr. E. A. Kingsley, of Little Rock, Ark., was elected president.

* * *

Chicago Subway Project.—Mayor Harrison of Chicago has sent to the City Council a proposed ordinance formally establishing a permanent commission to design, construct and maintain a subway system for passenger railway service in the city of Chicago. The City Council is to select the routes, but the commission is to have charge of the work, including the location of underground utilities affected by the building of the subway. The present subway commission is a temporary body and consists of Mr. John Ericson, city engineer; Mr. F. C. Shankland, a consulting engineer, and Mr. James J. Reynolds, a railway expert. The Mayor's proposed ordinance was referred to the committee on local transportation.

* * *

Toronto Muncipality to Take Over Suburban Electric Railway.—The board of control of the city of Toronto, acting on advice of the corporation counsel, has decided to give notice of the city's intention to take over, at the expiration of the franchise on Nov. 16, 1912, those portions of the Toronto & Scarboro Railway (now the Toronto & York Radial Railway) Company's line which lie within the city limits of Toronto. The sections to be taken over include the line operated by the Toronto Railway on Queen Street East from Howard to Oak Avenue, the Scarboro line on the Kingston Road from Queen Street to the east limit of East Toronto, the line on Queen Street from the city limits to Munro Park, and 300 ft. of line on Gerrard Street in East Toronto.

* * *

Commercial Section of the N. E. L. A.—The executive committee of the Commercial Section of the National Electric Light Association held a meeting Sept. 25 in Chicago. Mr. H. J. Gille, Minneapolis, chairman of the section, presided, and Mr. Philip S. Dodd, of Cleveland, the secretary, performed the duties of his office. Messrs. George Williams, New York; F. H. Golding, Rockford; G. N. Tidd, New York; Joseph E. Lukes, Reno; Joseph F. Becker, New York; H. L. Parker, Baltimore; John Meyer, Philadelphia; W. H. Hodge, Chicago; T. I. Jones, Brooklyn, and L. M. Wallace, Boston, were selected to direct committee work for the Seattle convention of next year. The Commercial Section has experienced a rapid development within the last two years and has now over 1200 members.

* * *

Brooklyn Company Section of N. E. L. A.—With the largest attendance in its history, the Brooklyn Company Section of the N. E. L. A. held its first fall meeting on the evening of Oct. 2, with Mr. M. J. Shugrue, president of the section, in the chair. Mr. H. W. Cluthe, of the fiscal department, presented a paper on "Rendering Bills for Electric Service," and Mr. T. W. Flowers, of the auditing department, one on "Storeroom Organization and Accounting." Each of these papers counts twenty points for its writer in the company's competition for delegates to the Seattle Convention. After animated discussion of the papers, and motion pictures, Mr. John F. Gilchrist, president of the N. E. L. A., was introduced, and made an interesting address on "Property Valuations," in which he pointed out the propriety of including an efficient organization among the assets of a company. Mr. W. W. Freeman, past president of the N. E. L. A., made a few remarks which were followed by refreshments and music by the company orchestra.

* * *

Newspaper Reporters and Technical Conventions.—An unpleasant feature of the recent Chicago convention of the Illuminating Engineering Society was due to the misdirected attention which it received from the newspaper press. A city press association supplied to the daily newspapers alleged interviews and brief reports of the proceedings so grotesque as to tend to give the meeting, in the eyes of the public, the character of an assemblage of men craving for sensational notoriety. One of the officers of the society was quoted as making disparaging remarks about the local gas company, which discourtesy, if true, would have been at once resented by numerous representatives of the gas industry present as members of the society. Another member was made to say that glaring lights "draw human faces into wrinkles and bring on premature age of the facial expression," and still another is quoted in headlines of several papers as saying that "artificial light causes tuberculosis." It is perhaps unnecessary to say that none of these gentlemen made any of the remarks in these alleged verbatim quotations. Some of the headlines that appeared are as follows: "Called Arc Light Unhealthy"; "Glare or Color in Light Makes People Crazy or Ugly"; "Light Causes Disease, Engineers Are Told." Chicago will lose prestige as a convention city, at least for technical bodies, if such journalistic buffoonery is unchecked by the responsible editors of newspapers.

HIGH-HEAD HYDROELECTRIC DEVELOPMENT IN NEW YORK.

Plant of the Mohawk Hydro-Electric Company at Ephratah, Fulton County.

Inflow Turbine Operated Under Head of 300 Feet—Energy Transmission at 22,000 Volts.

There has recently been completed at Ephratah, N. Y., a hydroelectric station, unassuming in appearance, but embodying marked hydraulic and other engineering features. The available head at the station is approximately 300 ft. and the equipment at present installed aggregates 3750 kw. Garoga Creek, whence the station receives its supply, has its source in the southern slope of the Adirondack Mountains and flows in a southwesterly direction to the Mohawk River, which it enters near Ft. Plain. On the headwaters of the creek are Peck and Caroga Lakes, which furnish storage for the development. A dam with a crest length of 1700 ft. and a maximum height of 40 ft. is built at the outlet of Peck Lake, while at the north end of the lake there is a timber-crib and earth-fill dike with a crest length of about 1900 ft. and a height of about 40 ft. Both of these dams serve to impound the water in the lake, which, with the existing storage afforded by Caroga Lakes, renders available for power purposes approximately 1,250,000,000 cu. ft. of water.

About 10 miles down stream a forebay dam has been constructed a short distance below Garoga village. This dam has a maximum height of 60 ft. and a crest length of about 750 ft. From the forebay dam the water is conveyed through a concrete tunnel 400 ft. long and 7 ft. in diameter; thence through a continuous-banded wood-stave pipe 78 in. in diameter a distance of 8600 ft.; thence through a 96-in. continuous-banded wood-stave pipe a distance of 1460 ft.; thence through a steel penstock 96 in. in diameter for a

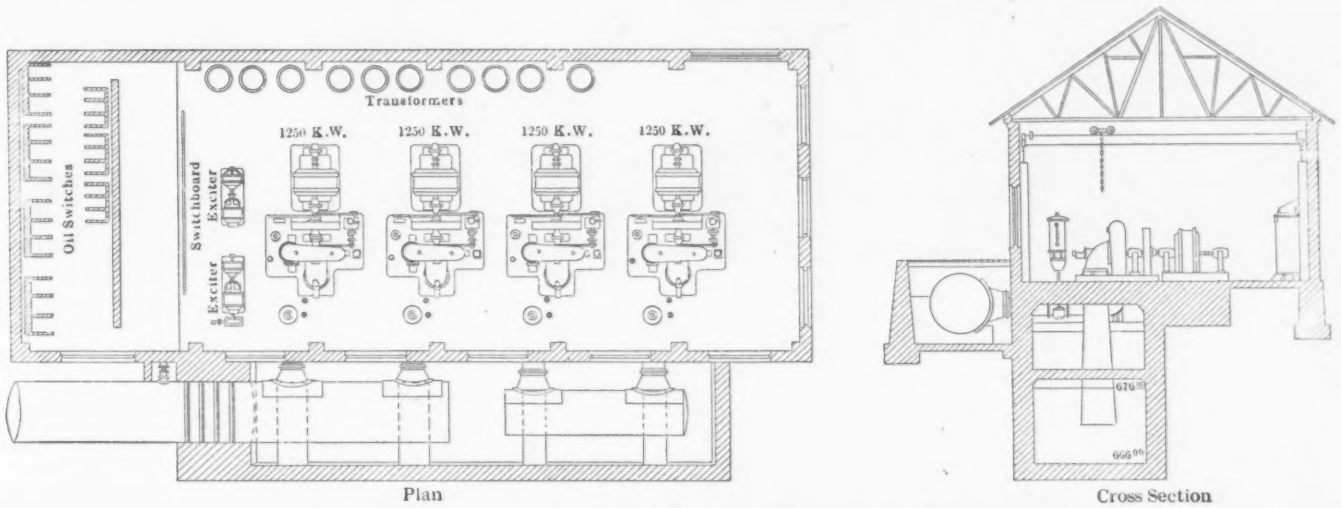


Fig. 1—Plan View and Sectional Elevation of Mohawk Hydroelectric Station.

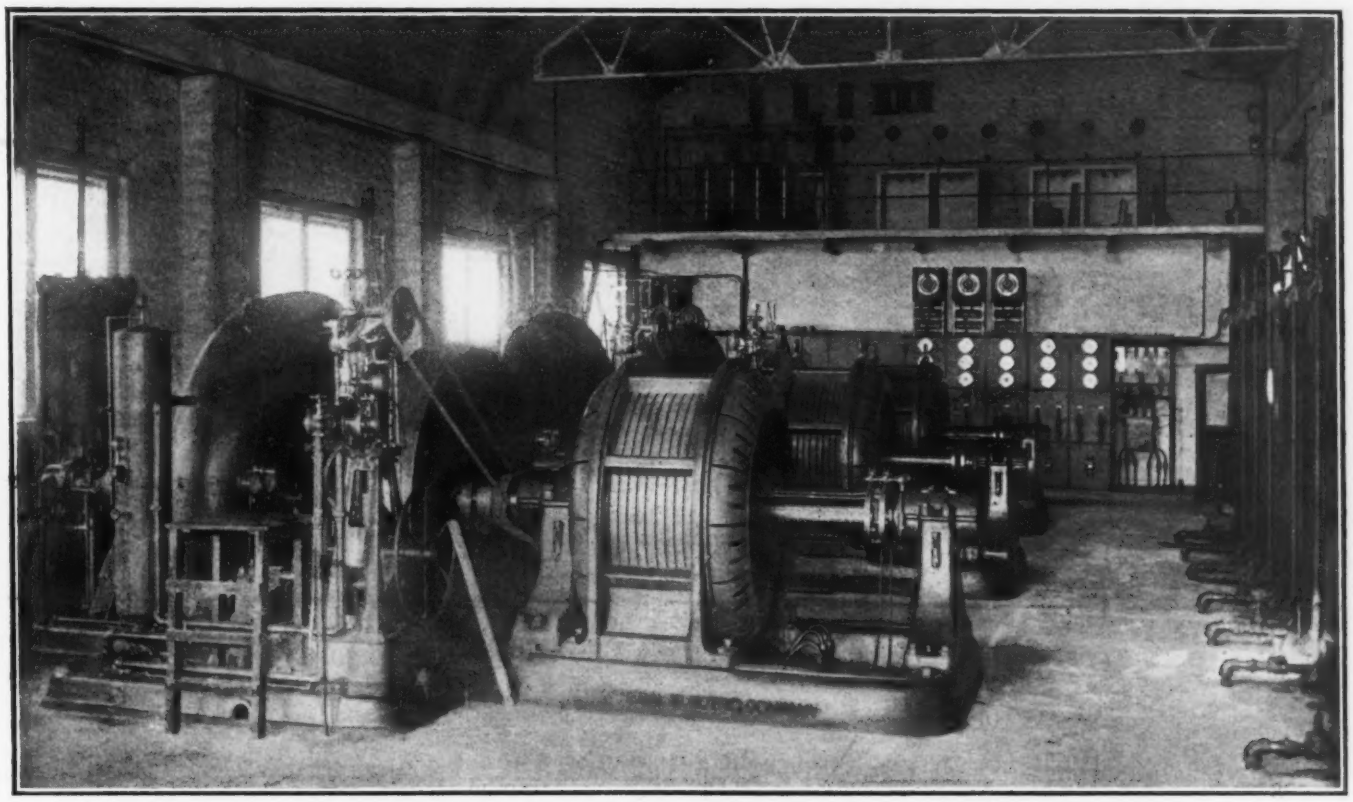


Fig. 2—Interior of Power House, Showing Wheels and Alternators and Transformers at Right.

distance of about 1000 ft. to the power house. A reinforced-concrete surge tank 25 ft. in diameter and about 50 ft. high is erected 2300 ft. from the station to protect the

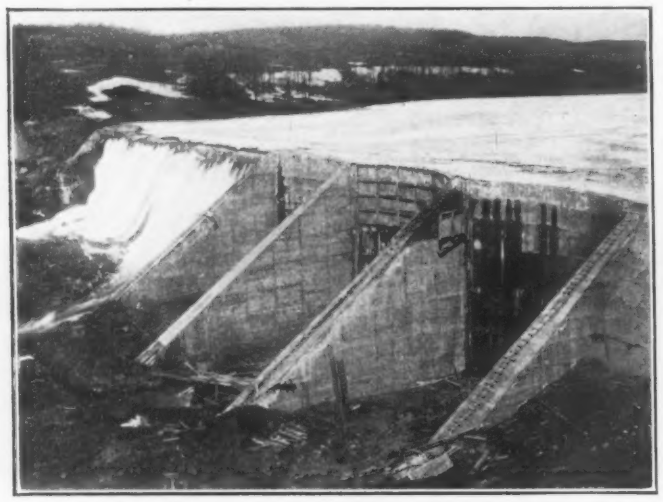


Fig. 3—Forebay Dam, Showing Spring Flood.

line against water hammer and to provide a considerable water storage reasonably near to the power house to insure close regulation on the sudden changes of the load.

The generating station is constructed of rubble masonry and is 103 ft. long and 38 ft. wide. Views of the exterior and interior of the station are reproduced herewith, as are also a plan and sectional elevation of the power house showing the arrangement of apparatus. The hydraulic apparatus comprises three 1750-hp Francis-type wheels built by the S. Morgan Smith Company. The wheels run at 720 r.p.m. and are equipped with Lombard governors and hydraulic relief valves. Each is direct-connected to a 1250-kw, three-phase, 60-cycle, 2300-volt alternator built by the General Electric Company, which company also supplied the rest of the electrical equipment. The units are fitted with 10,000-lb. flywheels. Sufficient floor space is available for an additional unit of the same rating as those at present operating. A Pelton waterwheel drives a 50-kw exciter unit, which may also be driven by an electric motor.

Fig. 4—Water Passing Over Weir. Load, 1966 Hp.

An additional motor-generator set is provided as a reserve exciter unit. The pipe line is carried along one side of the station and branches are taken in to the turbine wheels, a smaller branch supplying the exciter wheel. As indicated, any of the branches can readily be cut out by valves fitted to the feeders close to where they enter the building. Pressure on the pipe line is maintained constant by the surge

Fig. 5—Exterior of Power House.

tank mentioned above, which relieves the wheels of fluctuations in pressure in the line.

One photograph (Fig. 4) illustrates the weir installed in the tailrace for testing the units in the power house. This shows in a striking manner the small quantity of water required to produce nearly 2000 hp with the high head at which this plant operates.

The 2300-volt energy is stepped up to a tension of 22,000 volts by oil-insulated, water-cooled transformers. There are seven transformers at present installed in the power house with space for three future units, and these are arranged along the side wall of the station as shown in the engraving, making a very simple layout and one easily kept under surveillance. The control board is located at one end of the room.

About one-half of the station output is transmitted to Johnstown and Gloversville over the transmission line of the Fulton County Gas & Electric Company, a distance of 10 miles, feeding lamp and motor circuits of the latter company, the tension being, of course, reduced. Fig. 8 shows

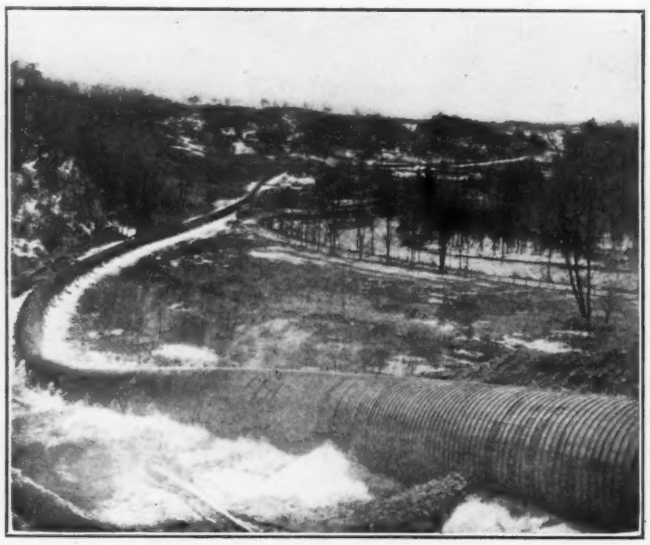


Fig. 6—78-in. Wood-Stave Pipe.

a typical A-frame transmission tower used on this line. There are four transmission wires in addition to the ground and telephone circuits, the fourth transmission wire being held in reserve. It is proposed eventually to equip the line

with two more wires so as to obtain a double transmission circuit. The station apparatus is protected by horn-gap type of lightning arresters and close regulation is obtained by means of a Tirrill regulator. The switchboard is fitted with the customary indicating and recording instruments.

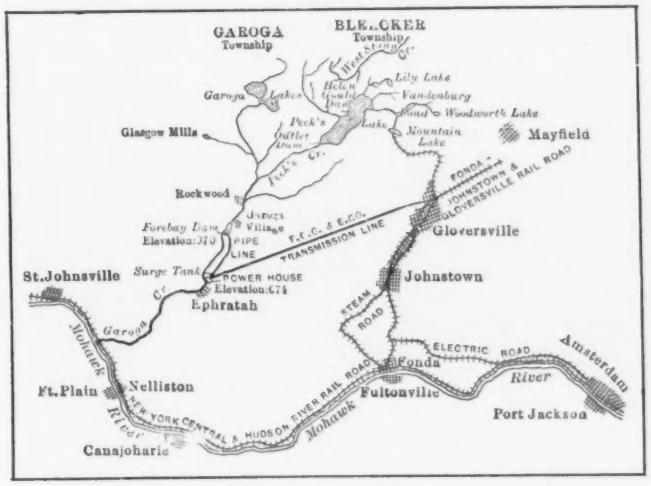


Fig. 7—General Plan of Mohawk Company's Development.

The transmission line to Gloversville runs in practically a straight line from the power house to the receiving station of the Fulton County Gas & Electric Company at Gloversville and is made up of "A" frame and four-legged towers, the spacing of towers being about 450 ft.

The design of the various hydraulic and electrical appliances has produced very satisfactory operation. The large volume of water in the surge tank available for sudden demands and the increased size of the pipe line from the surge tank to the power house, as well as the heavy flywheels, in addition to the governors and relief valve, have resulted in a remarkably constant voltage, the instruments showing a very slight variation under fluctuating loads.

The station has been in successful operation since Feb. 28. It was erected by the Kerbaugh-Empire Company under the supervision of Mr. E. A. Little, superintendent. The firm of Barclay Parsons & Klapp were the consulting engineers for the work. The New York office of the Mohawk Hydro-Electric Company is at 60 Wall Street and the officers are as follows : President, Mr. William Barclay Parsons; vice-president, Mr. W. J. Douglas; secretary, Mr. A. J. Nichols; chief engineer, Mr. H. M. Brinckerhoff. Mr. F. T. Coldwell, Ephratah, N. Y., is the superintendent of operation.

Fig. 8—Typical "A"-Frame Tower of Transmission Line.

HIGH-TENSION TRANSMISSION EXPERIENCE IN CENTRAL COLORADO.

Combined Steam and Hydroelectric System Transmitting a Maximum Distance of 300 Miles.

Details of Oil Supply for Boilers, Mountain-Line Construction, Switching Arrangements and Electrical Tests of System.

THE most conspicuous high-tension transmission development in the eastern section of the Rocky Mountains is that of the Central Colorado Power Company, which supplies electricity for general lighting and motor service throughout a large portion of the State lying between Glenwood Springs, Denver and the limits of the system of the Northern Colorado Power Company. As recently described in our columns, the Central Colorado system receives electrical energy from two generating plants, one being located at Shoshone, in the Grand River Cañon, and the other in the outskirts of Boulder, the equipment rating of each station being 10,000 kw. The principal markets served are Denver, Leadville, Georgetown, Idaho Springs, Central City, Breckenridge and Glenwood Springs. Energy is sold at Boulder to the Northern Colorado Power Company, which also operates a generating plant of its own at the Lafayette coal mines.

The extreme distance covered by the Central Colorado Power Company's service, including the northern district of Colorado during periods when energy is purchased by the Northern company, is about 300 miles. Energy is transmitted from the Shoshone and Boulder stations to Denver at 100,000 volts, each station being of the hydroelectric type. The Northern Colorado company transmits at 44,000 volts and serves a territory extending from Lafayette and Boulder northward to the Greeley and Ft. Collins districts.

The transmission system of the Central company extends from Shoshone to Denver and from Boulder to Denver, comprising about 182 miles of three-phase, 60-cycle line, carried on suspension insulators supported on steel towers. The line crosses the Continental Divide at three points, whose altitude ranges from 12,000 ft. to 13,700 ft. above sea level, and the operating conditions are among the most severe in the country. The high-tension circuits of the company consist of the following lengths of three-phase line, all wire being of copper: Shoshone to Leadville, 63.44 miles, No. 0; Leadville to Dillon, 31.26 miles, No. 1; Dillon to Denver, 58.82 miles, No. 0; Boulder to Denver, 27.23 miles, No. 1. Each conductor consists of a hemp-center, six-stranded cable, the spacing between phase wires being 10 ft. 4 in. About 1400 towers are required in the high-tension service, the local distribution of the company being handled by 13,200-volt and 6600-volt circuits carried on wooden pole lines. The standard tower is of A-frame design and rises to a height of 44 ft. above the ground, the foundations extending to a maximum depth of 6 ft. The minimum clearance of the wires in the middle span is 22 ft. from the ground. The average span between towers is about 730 ft., the maximum span being 2500 ft.

The generators are Y-connected, but all transformers except at Boulder are connected in delta, on both the primary and the secondary sides. The generators at Shoshone and Boulder deliver energy at 4000 volts to the primaries of transformers, raising the potential to 100,000 volts, each pair of machines being provided with three 3333-kw transformers. The lower voltage service is handled mainly by circuits ranging in size from No. 4-0 copper to No. 9 iron wire, the latter being used on short taps to the premises of small consumers, on account of its superior strength and cheapness. The six-strand cable was used on the high-tension line mainly on account of its increased smoothness. The low-tension pole line is built of 30-ft. to

40-ft. cedar and native-pine poles treated at the gains and butts by carbolineum. Over the Argentine Pass, at an elevation of about 13,700 ft., the high-tension line is duplicated for a distance of about 3 miles, the maximum distance between the two parallel sections being about 1 mile.

The transformers at Boulder station are Y-connected in order to give a better voltage ratio, the neutral point being ungrounded. Two ground wires are installed throughout the entire length of the Boulder-Denver line, and for 5 miles on either side of all substations on the Glenwood line, including the generating plant at Shoshone. Between Leadville and Dillon and across the Argentine and Hagerman Passes a duplicate grounding equipment is also in service. The ground wire consists of a 0.5-in. Siemens-Martin steel cable grounded to the cross-arm on the top of the tower through a mechanical clamp.

In some of the spans on the eastern slope of the range, where the line crosses the openings of canyons, excessive wind velocity has in the past shaken the conductors and at times mixed them up on the overhead structure, so that it has been necessary to dead-end the line at each tower and to guy the tower itself, increasing the horizontal stress in the line to a point nearer the elastic limit of the wire, and in one case the spacing of the phase wires themselves had to be somewhat increased. The guy wires consist of 0.5-in. Siemens-Martin steel cable, and on a few greatly exposed spans in the canyons the tower construction has been supplemented by the use of two 5/8-in. steel messenger cables.

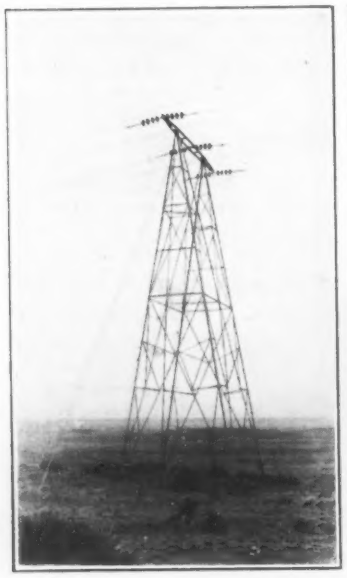


Fig. 1—Dead-Ending Line on Tower.

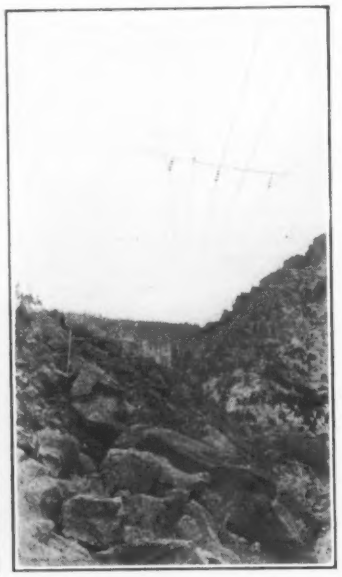


Fig. 2—Use of Suspension Insulator and Messenger Wire.

These cross the canyon at right angles to the direction of the conducting wires, and the latter are attached to the messengers either by dead-ending at strain insulators or by suspension insulators. The messenger cables are anchored into the rocks with eyebolts. On the upper portions of the passes sleet has at times attained a maximum diameter of 6 in. on the steel conductors used in these locations. Sleeve joints of copper are used on the line throughout the greater part of its length. Jumpers are used in the usual manner at all dead-ended spans.

No automatic oil switches are installed in the high-tension line, and oil switches of the manually controlled type are in use on the high-tension line only at the substations. The generators at each plant are provided with manually controlled solenoid-operated oil switches, and the outgoing lines are passed through disconnecting switches before being carried to the steel towers. Care is taken not to open the high-tension circuit when it is alive except under conditions of extreme emergency. Automatic oil switches are installed in the substations on the low-tension side of the system, but reverse-power relays are used only at the Denver substation in connection with the distribution of energy to the Denver Gas & Electric Light Company.

At Leadville the Central company operates in emergency connection with a 2500-kw steam auxiliary station, the boilers of which are kept partially banked, and in which an oil-burning system is available for the rapid raising of steam in case of a shut-down on the transmission system. Auxiliary hydroelectric service is also available for the Central system at local plants of small rating in Georgetown and Idaho Springs, and the Northern Colorado Power Company's steam station at Lafayette can feed energy back into the system if necessary. The total generating rating of all these systems, including steam plants owned and operated by the Denver Gas & Electric Light Company, is about 50,000 kw, and the energy distributed in co-operation with these various sources of generation is utilized in the mining and agricultural fields of the State and in the city of Denver for general lighting and motor service. The maximum load on the Central Power Company's system aggregates about 14,500 kw. The present load-factor is about 50 per cent, and the power-factor is usually unity.

The principal generating plant of the Denver company is the so-called West Side station, which is connected with the Central Colorado Power Company's system by a 13,200-volt, double, three-phase tie-line installation terminating in a bank of three 1600-kva transformers at the West Side plant and originating at a substation owned by the Central company which is located about 3 miles outside the center of the city. The high-tension circuits from Shoshone and Boulder are brought to the latter substation and by means of two pairs of 2500-kva transformers connected in open delta the potential is reduced from 100,000 volts to 13,200 volts. The tie-line installation to the West Side station is carried overhead, there being two three-phase circuits of 500,000-circ. mil aluminum in use. At the West Side station the potential is reduced to 2200 volts for the general distribution of energy throughout the city. Under present conditions of operation the Denver company purchases from 5000 kw to 6000 kw from the Central company; the day load is entirely carried on the latter service, the night load being divided between the two systems. During the day two Curtis turbo-alternators rated respectively at 2250 kw and 5000 kw are floated on the 2200-volt West Side station busbars, the generators running as synchronous motors, and being prepared to assume the load almost instantly in case of a partial or complete interruption of the hydroelectric supply.

Six boilers are equipped with oil-burning apparatus, all being of Heine make and having a total rating of 2850 hp. The boilers are of the hand-fired type, and water-gas tar is used for fuel in emergency service, the tar being obtained from the gas department of the Denver company. The tar is stored in two 10,000-gal. steel tanks, located underground and outside the West Side station, concrete saddles being used to support the tanks, each of which is 3 ft. long and 6.5 ft. in diameter. From the storage tanks the tar is forced into a 5000-gal. pressure tank by a steam pump, the tank being about 30 ft. above the burners. By gravity feed a 4-in. pipe line delivers the oil to the boiler-room, the oil being supplied to the burners at a pressure of about 15 lb. per square inch. The oil pump is a double-acting equipment with 4-in. x 3-in. x 6-in. cylinders. The oil-feed line is provided with a ½-in. steam pipe inside its indoor length for the purpose of preventing the thickening of the oil in cold weather. Each of the storage tanks is also equipped with a steam coil of the same size, and about 80 ft. of pipe is used in the two. A 1-in. steam line is also carried through the pressure tank and delivery line in the outside section of the latter.

The burners are of the Best type, with a by-pass valve at each providing for the blowing out of the oil-delivery nozzles by steam when desired. The burners deliver oil

through ¾-in. lines to the fronts of the boilers, the injected flame being carried into the furnace at a height of 8 in. above the firebrick grate lining. Two burners are installed per boiler. One boiler is equipped for oil burning only, and this is kept in operation all the time to maintain the oil

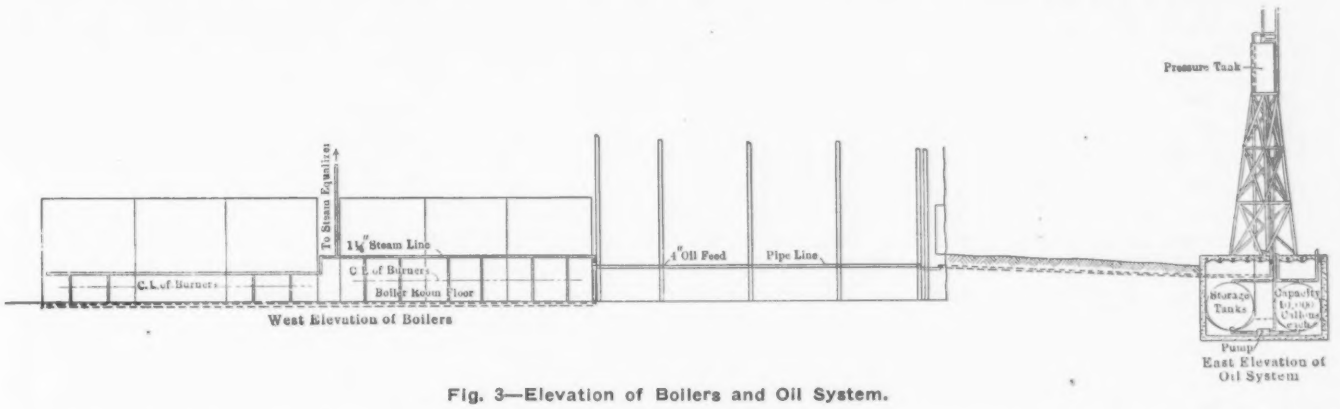


Fig. 3—Elevation of Boilers and Oil System.

circulation, about 600 gal. of tar per day being consumed in the furnace. Non-return stop valves are installed on all boilers with oil burners. The stop valves are drained by ½-in. pipes through check valves to a feed connection at the hand-hole plate at the bottom of the boiler water leg, and the condensation of the steam main is also returned to the water leg through a receiving tank and trap system. About 800 lb. of water per hour is delivered by condensation from the main header to the boilers, there being about 5000 sq. ft. of surface in the main piping.

In normal operation the steam pressure in the oil-burning boilers is maintained at from 2 lb. to 5 lb. below that in the main, coal fires being banked as much as possible in the oil-burning furnaces. In case of an interruption of the hydroelectric service a gong rings in the boiler-room. All dampers are at once opened, and next all ash doors are opened, after which the oil burners are cut into service. The burners of all six boilers can easily be cut in inside of two minutes, and in three minutes the full heat of the oil flames is available. Once a week a practice drill is carried out, the time of the drill being known only to the chief operating engineer of the station. At this drill the connection with the hydroelectric system is cut off and the turbines are thrown into service as quickly as possible. In a typical service interruption the load on the station was about 6000 kw, 4000 kw being suddenly dropped by the Central Colorado company. This threw a demand for about 4000 kw upon the boiler plant without an instant's warning. The oil burners were at once thrown into service and the Denver company's load was carried with a drop in frequency of only half a cycle. After the boilers have assumed the load at normal steam pressure the oil-burning system is shut off and the balance of the interruption is

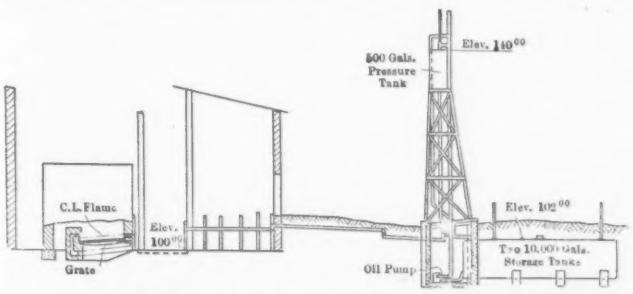


Fig. 4—Section Through Boiler and Oil System.

carried by coal fires on all portions of the boiler plant which may be required.

The accompanying diagram shows the principal operating connections at the Central Colorado company's Denver substation and between the stations of the Denver company and the former. These have been worked out with great care to provide for continuity of service under all anticipated conditions. Each incoming 100,000-volt line is controlled by a high-tension oil switch, a high-tension transfer bus with oil switch being provided between the two lines. These switches are of the solenoid-operated type, with hand control only, and automatic switches are located only on the secondary or 13,200-volt sides of the step-down transformers at the substation. Direct current for the operation of the solenoids is obtained from a small storage battery charged through a motor-generator set. The oil switches on the 13,200-volt side of the station are of the solenoid type, with automatic operation in most cases. A tie switch is provided on this side of the system between the two incoming lines, and beyond the bus-junction switch an oil switch is included in each of the lines running to the West Side station and the so-called Lacombe station of the Denver company. Disconnecting switches are installed on each side of all high-tension oil switches, to permit safety in inspection and repair work.

At the West Side station, which is the operating center of the Denver system, the two incoming tie lines from the Central company's substation are multipled on a set of busbars connecting with the step-down transformers, and on the secondary side of the latter connection is made with the West Side 2200-volt station bus through two oil switches, one being equipped for non-automatic operation and the other, nearer the bus, for operation by automatic reverse-power relay connections. The local feeders from the West Side busbars are installed in two switchboard sections, one section being supplied with energy directly from the busbar and the other from tie-line connections tapping the incoming power leads half way between the two oil switches *A* and *B*. An auxiliary connection is also

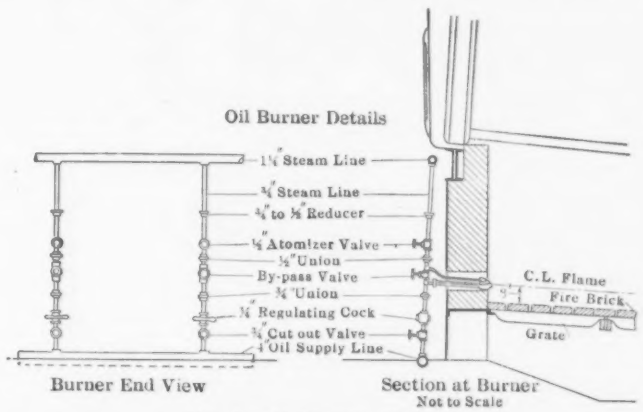


Fig. 5—Oil-Burner Details.

made between the switchboard and the Lacombe station, the latter being tied in with the Central company's substation through an 11,000-volt, three-phase line which necessitates the use of an auto-transformer installation to secure the proper secondary voltage on the tie line at the substation. At the Denver company's generating plants each

lead between the machine and the switchboard is connected with an automatic oil switch operated by a time-limit, reverse-power relay.

In normal operation the tie switch *L* between the two incoming 100,000-volt lines at the Denver substation is open, the tie switch *G* between the 13,200-volt leads being closed. In case trouble occurs on the Shoshone line, for example, which would be sufficient to shut down a generator if not relieved, the following procedure occurs: Secondary tie switch *G* opens by the action of the instantaneous reverse-power relay 2 or similar relay 3, through reversal of flow of energy from the turbo-units at the West Side plant. If the system has been operating with the high-tension tie switch *L* closed, this will also be opened by the action of the above relays. Boulder generating station now feeds energy back through the West Side station to time-limit reverse-power relay No. 4, opening the oil switch *J* and switch *A*. The operator at the West Side plant then ascertains whether the interruption is continuous or not by noting the condition of the pilot lamps on feeders 1 to 12. If these are out, he opens switch *B* at once by remote control, and closes *A*, which puts the foregoing feeders on the 2200-volt station bus. He then arranges with the Central company to synchronize across switch *B* or to synchronize at the substation after the switch *B* is closed. In case switch *A* opens and the pilot lamps indicate that the Central company's service is intact the two companies synchronize across switch *A*. Similar instructions apply to the handling of the service between the Central company's substation and the Denver company's Lacombe station.

On the switchboards of the Central Colorado company's operators are line ammeters and remote-control switches by which any generator may be disconnected from the system. In case of trouble the station operator lowers the voltage

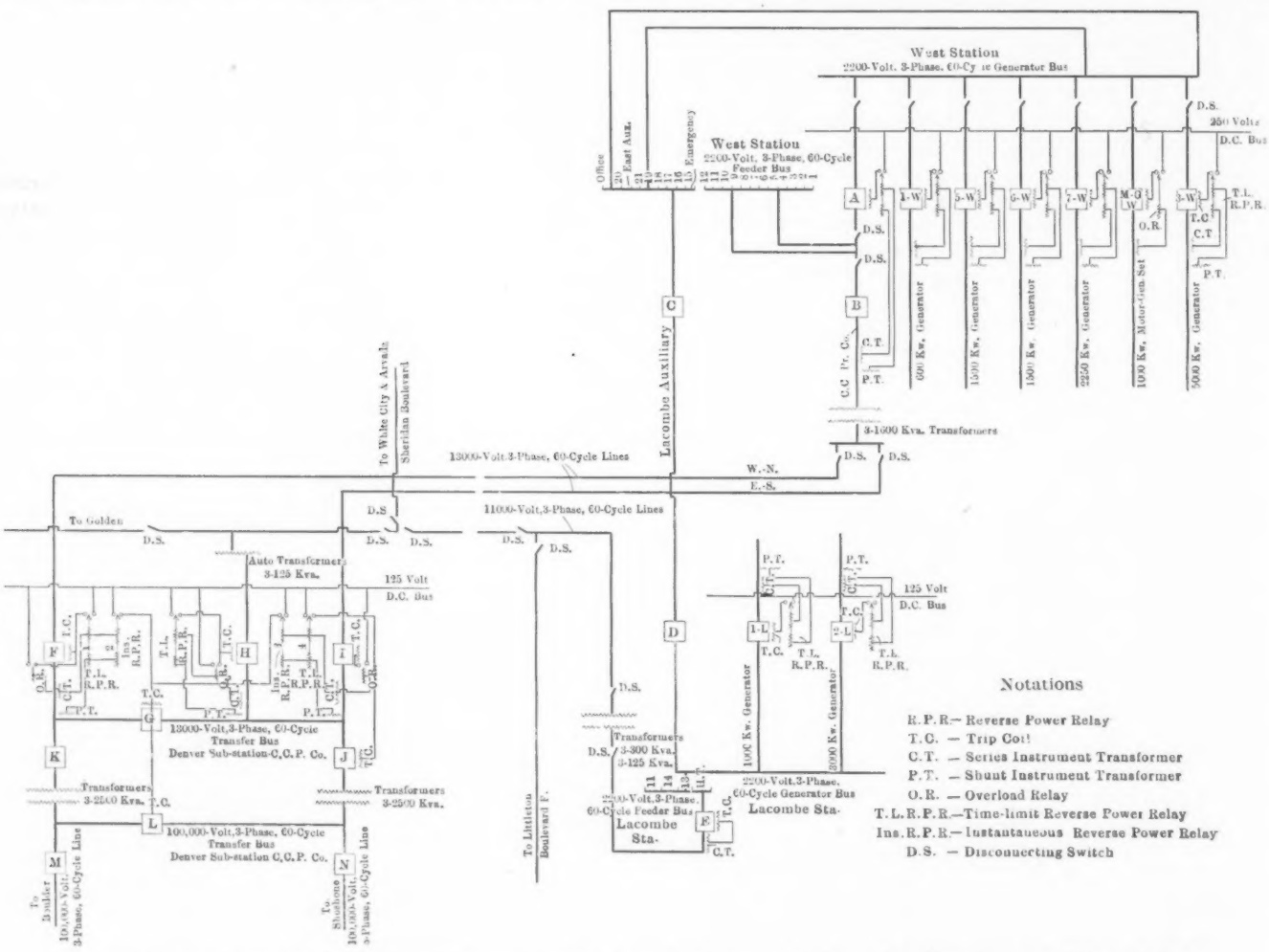


Fig. 6—Diagram Showing Connections Between Central Colorado Company's Substation, Lacombe, and West Stations.

cutting off the secondary circuit from the Shoshone transformer line. The operator of the Denver substation then opens oil switch *N*, closes switch *L* through his remote-control battery circuit, closes *J* and usually closes switch *G*. The Boulder station then carries the load until the emergency is over.

When the trouble is removed the operator at Denver receives orders to synchronize the lines. He opens switches *L* and *J*, closes Shoshone line switch after making sure that the line voltages are in time phase, closes *G* and instructs the station operator at Shoshone to take the proper proportion of the load. Time-limit reverse-power relays 1 and 4 are mechanically interlocked so that only one can be closed at any given time.

At the West Side station of the Denver company, in case the hydroelectric service is momentarily interrupted, the reversal of energy flow from the turbo-alternators opens and gets the generating units under control as soon as possible. If the trouble does not burn clear in a few seconds the line may be opened by cutting out the generators. The substation operators are instructed when necessary to open particular sections of the line feeding energy from the transforming points, and so far as possible the system is operated so that in case of trouble the load on each side of the fault can be carried by the two stations at the ends of the system, each feeding energy to the disconnecting switch nearest the trouble.

At present two complete patrols of the line are made weekly, and after severe lightning storms special patrols are made. The line work is handled by a force of fourteen men, including a foreman, whose headquarters are at Denver. From 8 miles to 22 miles of line per man is the assignment. Most of the inspection is done on the 100,000-volt system. In summer the work is handled on horseback and

in winter on snowshoes. On each side of the Argentine and Hagerman Passes are located two linemen's cabins, these being used as winter quarters by an average of two men per cabin. Telephone connection is maintained with the entire system, and the continuity of service on the most difficult portions of the line is in the hands of this force. Insulator repairs are made only when the line is shut down, and special care has been taken at all disconnecting switches on the high-tension circuits to provide for grounding the phases when the line is open.

High-tension oil switches receive a thorough inspection monthly. No trouble has been experienced on the combined telephone and telegraph circuit that ties the system together, this being carried on a separate pole line on the company's right-of-way, which has a maximum width of 100 ft. Linemen carry portable telephones, pliers and a few small tools, but the heavier supplies are maintained in 4-ft. x 4-ft. wooden huts located about 5 miles apart on the average. Forty-two of these supply houses are in service on the system. Fuses are not used on the system except in connection with certain low-tension distribution circuits. Linemen ground each phase when working upon the line, and make weekly reports to the headquarters office in Denver, where a load dispatcher or system operator is on constant duty. The line is equipped with section switches, by which patrolmen can isolate portions from 12 to 15 miles in length, the load being carried from each end in such instances. Aluminum-cell lightning arresters are in service at substations and in the generating plants, and have given excellent satisfaction.

In July, 1911, the system averaged less than two interruptions per customer, and the total duration of outages on the entire system, including both high-tension and low-tension service, was 11 hours 37 minutes. There were 1.24 accidental interruptions per customer and 0.16 prearranged cut-offs per customer. On the 100,000-volt system in July, 1911, there were only two accidental interruptions. In one case lightning broke a roof bushing, cutting off the Shoshone plant for one minute and the Dillon substation three minutes, the Leadville substation being off for one minute. The Boulder station was not affected. In the second case an insulator failed on a steel tower, thereby causing the Boulder station to drop one phase, the Denver company's system being disconnected for five minutes. There were also prearranged disconnections of the high-tension line for repairs on four sections, aggregating four hours of non-service. During the month there were fourteen days of lightning storms on the system, low-tension disturbances being caused in four cases and high-tension disturbances in four instances.

The principal line improvements effected by the company have been the dead-ending of certain spans as outlined above, the tightening of cables on spans subject to swinging shorts, the use of storm guys on towers, about 150 structures having been guyed thus far, and the use of compound-filled bushings on high-tension transformer leads in place of the former oil-filled bushings. The diameters of the bushings have also been increased. Another improvement consists in the strengthening of the connecting links between the unit sections of the suspension insulators. No difficulty has been encountered in the operation of high-tension switches, and the insulators have given excellent service. The aluminum-cell lightning arresters have also given special satisfaction.

The following tests on the system are representative:

Ninety kilovolts at Shoshone, 500-kw loss; charging current, 45 amp. Approximate connections, 5000-kw Y-connected alternator, three transformers at Shoshone, delta-connected.

No load losses, Shoshone-Denver line.

One hundred and fifty-three and one-half miles three-phase No. 0 copper, spacing 124 in. One hundred kilovolts at Shoshone, 1200 kw loss; charging current, 50 amp. Ninety kilovolts at Shoshone, 500 kw loss; charging current, 45 amp. Approximate connections, 5000-kw Y-connected alternator, three transformers at Shoshone, delta-connected.

No load losses, Shoshone-Leadville line.

Sixty-three and one-half miles, three-phase No. 0 copper, 124 in. spacing. One hundred kilovolts at Shoshone; line loss, 210 kw, rainy day; charging current, 18 amp. Ninety kilovolts at Shoshone, line loss; 80 kw, rainy day; charging current, 16 amp.

No load losses, Denver-Boulder line.

Twenty-seven and three-fifth miles single-phase connection, No. 1 copper, spacing 124 in. One hundred kilovolts at beginning of line; corona and insulator losses, 11 kw. Ninety kilovolts at beginning of line; corona and insulator losses, 6.5 kw.

The commercial development of the company is illustrated by the fact that in January, 1910, six months after the Shoshone plant was started in service, the company had a commercial connected load of 10,581 hp and sold 2,103,785 kw-hours. In July, 1910, the connected commercial load was 16,268 hp and the sales were 2,490,712 kw-hours. In January, 1911, the connected load was 20,171 hp and the sales were 3,073,773 kw-hours, and in July, 1911, the connected load had risen to 22,623 hp and the sales of energy to 4,508,006 kw-hours. The Boulder plant was placed in operation in the late spring of the present year. The standard motor service rates of the company are based upon a fixed charge varying from $39 down to $12 per hp-year, plus an energy charge varying from 1.3 cents to 0.5 cent per kw-hour, according to the consumption.

REMOTE CONTROL OF MUSICAL INSTRUMENTS

A System Employing the Ordinary Paper Music Roll and Providing Control of Expression.

By Norman G. Meade.

THE growing demand for automatic musical instruments, including pipe organs, orchestrions and pianos, has led to the development of several types of remote electric control, many of which embody disadvantages, including the expensive brass music roll as used in the straight electric control.

The writer has developed a system of electrical operation for musical instruments in which the customary paper music roll is employed and in which are several novel features, described in this article. In this system the

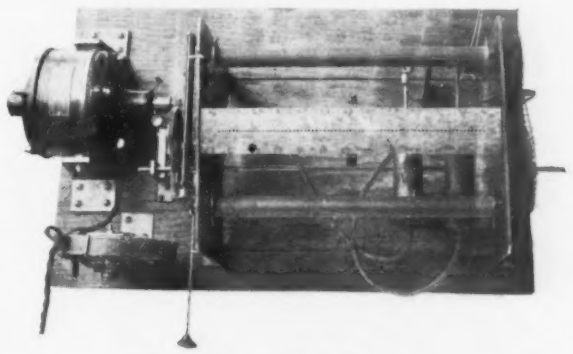


Fig. 1—Plan View of Player.

translating device is entirely separate from the piano or organ and may be located where convenience dictates.

The mechanism includes a chamber, or hollow cylinder, having a series of holes in one wall, means for exhausting the air from the chamber, a series of spring-contact members, and pins which are fitted loosely into the holes in the chamber wall and which are adapted to effect the closure of electric circuits through one or more of the spring-contact members when atmospheric pressure is

applied to their outer extremities. These contact members correspond in number and relative location to the keys of a piano or organ and several additional contact devices are provided which are adapted to effect the automatic control of the tempo, or rate of playing, and the touch, or force with which the piano hammers are actuated. The admission or exclusion of air pressure to the chamber depends upon the perforations in the music roll, which is

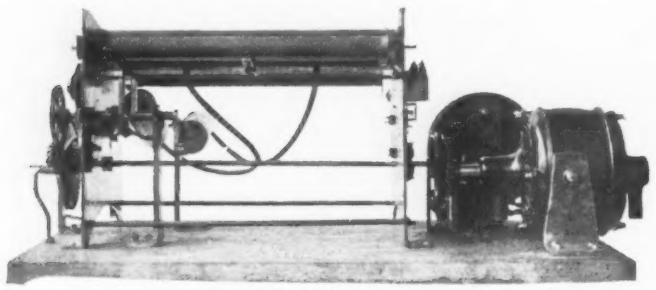


Fig. 2—Side View of Player.

passed over the chamber from one roll to another in a well-known manner, and additional perforations, as will be explained later, provide for the control of expression.

In the accompanying illustrations Fig. 1 is a plan view of the translating device or player. Fig. 2 is a side elevation, Figs. 3 and 4 end elevations, and Figs. 5, 6, 7 and 8 detail views of the device shown in Fig. 1. In the latter figure the vacuum chamber, the rolls for supporting the music strip, the framework, motor and gearing are shown. The air is exhausted from the vacuum chamber by means of the oscillating pumps, shown in Fig. 2. A main driving shaft of the mechanism is rotatably mounted in stationary bearings and connected to the motor by a train of gears. The pump shaft is driven from this main shaft by sprocket wheels and by a chain gear, as shown in Fig. 3.

The rolls are rotatably mounted upon shaft projections between the end brackets and spur-gear wheels are attached to corresponding ends of the rolls on the extremities of the shaft projections, which extend through the frames. A bevel-gear wheel is attached to the oposite shaft projection of the front roll, as shown in Fig. 4. This meshes with another bevel gear attached to a threaded shaft having a traveling nut. When the music is being played the nut travels toward the left. When the tune is finished a predetermined perforation in the music roll

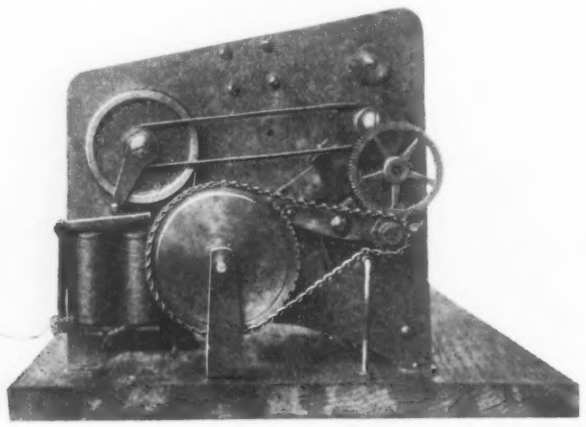


Fig. 3—End View of Player.

causes the circuit to be closed through the electromagnets which actuate the lower of the two switches shown in the illustration. The closing of this switch closes another circuit through the electromagnets shown in Fig. 3. The armature of these magnets disconnects the gear from the take-up roll, disconnects the pumps and rotates the music roll in a direction to rewind the paper. Referring again to Fig. 4, the travel-nut on the screw shaft, which now rotates in the reverse direction to that traveled when the music is playing, returns to the right-hand side and trips the upper switch at the completion of the rewinding of the music roll, thus stopping the motor. The motor is started by pressing in a rod projecting from the frame.

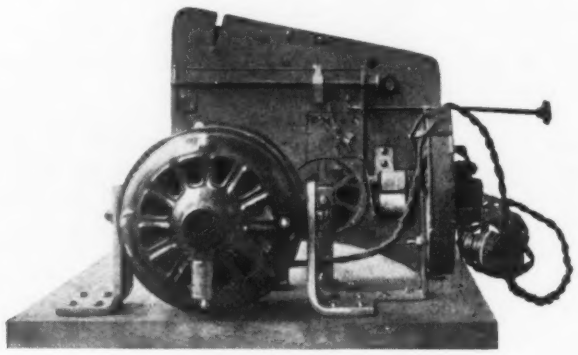


Fig. 4—End View of Player.

In obtaining the expression, particularly variations in tempo and touch, the device shown in Fig. 5 is employed. It consists of a plurality of stationary contact-ring segments, a rotatable engaging contact arm with a ratchet wheel attached thereto, and an electromagnet whose armature actuates a pawl. Connected to the ring contacts are several sections of resistance, one being in circuit with the motor and one in series with the magnets operating the keys of the musical instruments.

Fig. 6 is a cross-sectional view of the pneumatic chamber. The frame is represented by *a; b* is a curved metal plate with the perforations *c* for the air to enter the small, narrow chamber *d*, passing thence through the hole *e* to the pin *f*. This presses down the spring *g* onto the contact *h*, closing the circuit through the magnet connected with it.

The magnets may be connected to the under side of the keys to pull them downward or to the upper side, as shown in Fig. 7. As the distance between the centers of the magnets is relatively greater than that between two adjacent keys, they are staggered and placed in three horizontal rows as shown.

The electromagnet shown in Fig. 8 comprises practically a closed magnetic circuit of rectangular shape. The core member is provided with a magnetizable strip that is rotatably attached to the core proper and is adapted to

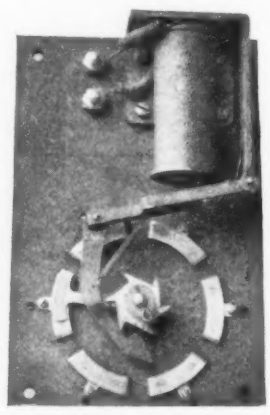


Fig. 5—Device for Varying Tempo.

close the magnetic circuit completely when a magnetic field is produced by energizing the magnet winding. This movable member is mechanically connected to one of the piano keys by means of a wire or strip the lower extremity of which is hooked into engagement with an eyelet.

Fig. 9 is a diagram of the circuit connections. The motor may be of any suitable type having a variable-speed characteristic and may be supplied with energy from any

suitable source. The connections shown are for a compound-wound, direct-current motor and may be traced as follows: Energy is supplied from a relatively high-voltage circuit through a variable resistance *R* and a switch *S*

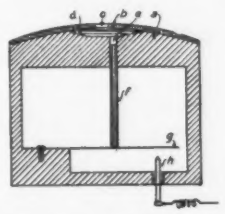


Fig. 6—Cross-Section of Pneumatic Chamber.

to the motor. The variable resistance is intended to effect the speed regulation of the motor rather than to serve as a starting rheostat, and in case an alternating-current motor is employed for driving the device this resistance can be replaced by an auto-transformer or other suitable means for varying the voltage applied to the motor circuit. As illustrated, the resistance *R* is controlled by a device such as that shown in Fig. 5, and under normal conditions the movable contact arm occupies a position

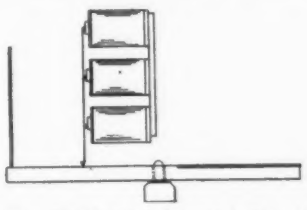


Fig. 7—Magnet Connected to Upper Side of Key.

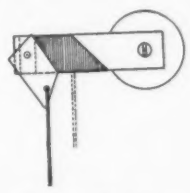


Fig. 8—Electromagnet

such that approximately half of the resistance is included in the motor circuit and, therefore, a speed variation is permitted in either direction. A reasonable amount of the music roll is left without perforations so that the motor may have an opportunity to accelerate, and, when normal conditions obtain, the roll will be traveling over the inlets in the vacuum chamber at a substantially constant speed. As predetermined perforations in the music roll pass over the inlets corresponding to the desired keys, cer-

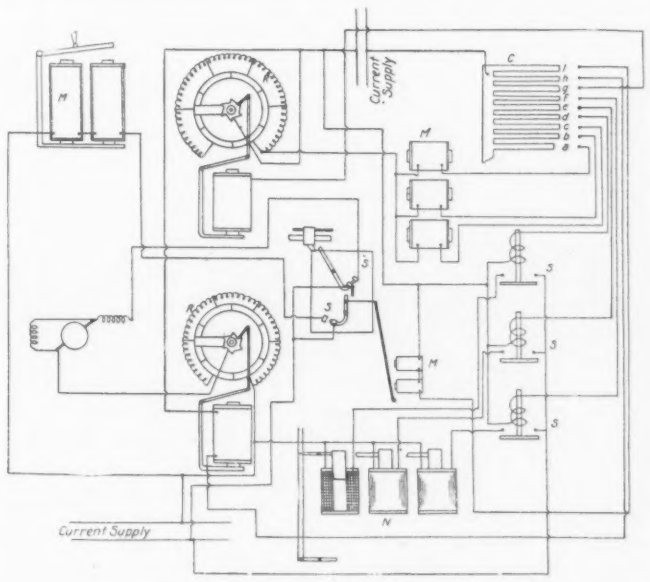


Fig. 9—Diagram of Connections.

tain of the pins in the vacuum chamber are given a downward motion so that the corresponding contact fingers engage the stationary contacts. A circuit is now completed from the source of supply to the comb or notched strip *C*, through the stationary contact terminals and conductors to windings of magnets *M*, the circuit being completed from these points through a single resistance *R* to the negative terminal of the battery. The resistance *R* is representative of any suitable voltage-varying means and may be mechanically arranged, as shown in Fig. 5. In this case, as before, under normal conditions the movable contact arm occupies such a position that approximately one-half the resistance is included in the circuit.

Inasmuch as the function of the pedals of a piano or organ is well known, it is unnecessary to describe them, but with the system here described these parts are actuated as illustrated in Fig. 9 by means of electromagnets *N*. These magnets are provided with windings and movable core members that are severally connected to the pedal-actuating rods by means of links. The magnet windings may be energized selectively by the closing of the control switches *S*. These switches are electrically operated, being equipped with magnet windings, which, in turn, may be energized when contact fingers *d*, *e* and *f* are moved into engagement with their co-operating stationary-contact terminals. It will be readily understood that the desired pedal action may be effected by providing suitable perforations in the music roll for selectively applying air pressure to the pins that correspond to the contact fingers *L*.

The regulation of the tempo is effected by increasing and decreasing the active portion of the resistance *R*, and the touch or the force with which the hammers are actuated may be varied by decreasing or increasing the active portion of the resistance *R*. The regulation of the resistances is dependent upon the actuation of the contact fingers *h* and *g* and is similarly effected.

When the music strip has been wound onto the roll until all of the music-producing perforations have passed the intake holes in the vacuum chamber, a single perforation is provided for actuating a spring-contact member *i* which completes a circuit through the magnet *M* to close the switch *S*. The closure of this switch energizes the magnet windings of another electromagnet from the main source of energy. This reverses the music roll, which rewinds as has already been described.

MOTOR TESTING.

Equipment and Instructions for Testing Electric Motors in Industrial Plants.

By Samuel P. Goodale.

ONE of the benefits attending the introduction of electrical distribution of power in industrial plants is the ease with which measurements of power requirements and use may be made. Another benefit of which advantage is being taken more and more is the analysis which may often be made of machine action by the aid of recording or curve-drawing wattmeters. It is the purpose of this article to outline some of the methods and utilities of testing motors in service in manufacturing plants. Such tests are of interest to three classes of people: (1) Motor builders, who must know the requirements to be met in various industries in order intelligently to plan and sell their products; (2) central stations, whose interest is of the same general order, and (3) manufacturers who desire to conduct their plants under the most economical and advantageous conditions. In general, similar methods will meet the needs of these three classes.

Obviously the equipment should comprise as few pieces of apparatus as will serve the purpose thoroughly. The most essential meters for testing motors are voltmeter, ammeter, indicating wattmeter, recording wattmeter and watt-hour meter. For alternating-current work these may be chosen of such capacity that, with the aid of transformers, one meter of each kind will serve for any range of motor sizes. Care must be taken to choose meters whose own power requirements will not overtax the transformer's

capacity and, conversely, to choose transformers of sufficient size for the meters. It may be noted that trade bulletins do not give specific information on this point. A considerable amount of care in choosing meters best adapted for the conditions to be met will be well repaid.

The use of meters in testing is much facilitated by the provision of a permanent stand on which they may be placed. The stand should provide ample room for meters, switches and connections, be of such size and shape as not to interfere with its location near the motors to be tested, and be easily movable. Switchboard-type meters can best be mounted on an upright panel and portability secured by mounting the panel upon a truck, the top of which will provide room for the transformers. If available, the portable-type meters are more desirable. A box form of structure has the advantage of affording better protection to the meters and connections and being well adapted for shipment, but, on the other hand, it is more complicated and inaccessible. A table is, in general, the most convenient and adaptable form of construction for a testing stand. Fig. 1 shows side and end views of a table which has been used with much success in testing an installation of three-phase, 550-volt motors ranging in size from 3 hp to 175 hp. With very few changes this form may be adapted to almost any conditions met in testing motors in service.

The table top is made 2 ft. x 4 ft. The legs are set in somewhat to give more clearance when moving the set through narrow aisles. An upright wooden panel is bolted near one end of the top to provide for a recording wattmeter and watt-hour meter, the available meters being of a switchboard type. Flexible meter leads (not shown) project through the table top and are so arranged as to go directly to the proper binding post without any crossing when the meters are in position.

On both sides and at one end boards are nailed to the table legs and extend down about 13 in. Rigidity is thus secured as well as room for other attachments which add to convenience and adaptability. A rectangular hole is cut out of the board on one side to make room for a fiber panel *A*, with binding posts, to which are connected the leads from the meters. From other binding posts on the same panel leads are carried to the terminals of the test set. By connecting the proper binding posts with suitable jumpers any desirable scheme of connections for the meters, with or without the transformers, may be easily worked out and changes made when necessary. It should be noted in passing that a connection panel of this sort may be made so complicated as partly to destroy its value.

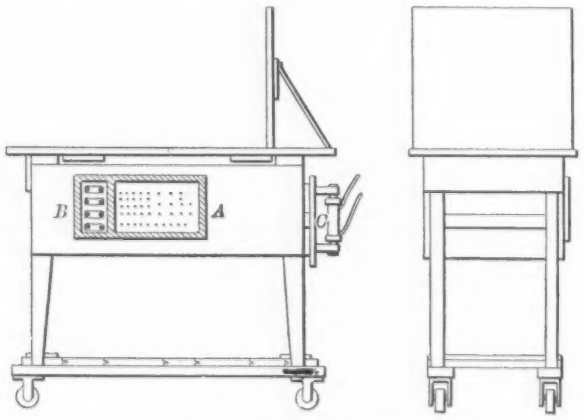


Fig. 1—Side and End View of Test Table.

Its use should be limited to those connections which are likely to need changing, and so employed it contributes markedly to the convenience and ease of manipulation. The meter fuses, *B*, are mounted adjacent to this connection panel.

To facilitate connections to the motor circuit use is made of fuse blocks, *C*, mounted on the end board of the table. The fuse clips of these blocks form the terminals of the test set. Wires attached to the caps of blown fuses, as indicated in Fig. 1, form a connection between test set and motor circuit exactly resembling the familiar plugs and cord used on telephone switchboards. If the motor is protected by a circuit breaker and no fuse block is conveniently located, it will be necessary to use some other form of connection to the motor circuit. For this purpose Dossert connectors are both neat and convenient.

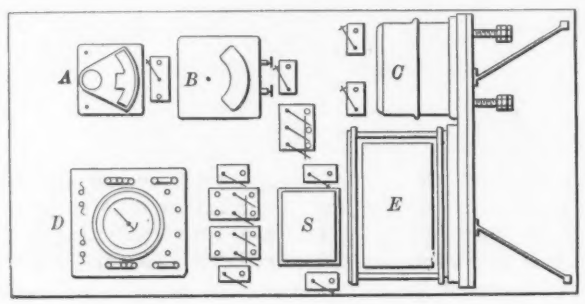


Fig. 2—Arrangement of Meters and Switches.

The table is set loosely on a flat truck made for the purpose and prevented from slipping by cleats on the truck. Pieces of felt or other elastic material placed under the table legs absorb vibration and jar and lessen their injurious effect upon the meters. The flat top of the truck forms the logical place for transformers and any other material needed.

Fig. 2 is presented to show the arrangement of meters and switches used. *A* indicates the voltmeter; *B*, ammeter; *C*, watt-hour meter; *D*, indicating wattmeter; *E*, recording wattmeter. One three-pole switch is provided to cut all current off potential leads and a single-pole switch for short-circuiting each meter current coil. Two two-pole, double-throw switches are used to reverse the direction of current in the series coils of the indicating wattmeter and provide for entirely disconnecting those coils when using the wattmeter alone to determine power-factor. One single-pole, double-throw switch permits of throwing the voltmeter to either one of two phases. These switches are all small knife type and in addition to their other use permit the removal of meters while motor is in use, this being sometimes desirable. They are mounted in such location as to indicate their use and are wired through the table top. Knife switches are preferred to snap switches, as their position is apparent at a glance. A sketch, *S*, showing the permanent wiring of the table is placed where it may be readily consulted and a glass cover is used to keep it free from dirt. The sketch will save tracing out wiring or reliance on memory and is, in fact, a necessity when the use is intermittent.

Protection to the table and meters and provision against accidental contact may be provided according to the circumstances of use. In particular the connection panel, fuses and fuse block terminals should be covered in such a way as to afford complete protection against accidental contact without interfering with easy access. A hinged cover would be suitable. The permanent wiring is protected by the construction used.

It is very convenient and quite possible to be able to move the test set from one part of a factory to another without removing meters. The meters should, however, be rugged in construction and much care be taken lest shock and jar from moving affect the delicate bearings. Most portable indicating meters are provided with a device to lock the moving element in place while the meter is being handled and this feature should be looked for. The moving elements of recording and watt-hour meters may be secured by blocking with folded strips of paper. Rubber-tired wheels are effective in lessening vibration, though by no means necessary. The provision made on the table

illustrated is in the form of felt placed under the table legs as before mentioned, supplemented in some cases by a mat of cotton placed under the different meters.

Relay-type recording wattmeters deserve special consideration. These meters are usually provided with adjustments to control their sensitiveness and quickness of action, changes being needed to adapt them to the characteristics of different circuits. If a meter of this type is used it should be mounted so that the various points of adjustment are accessible without removing the meter from its place. It is a peculiar fact and one worthy of mention that a particular meter of this type gave notably better results when subjected to the vibration in the factory rooms than when located on the station switchboard.

In making a test the indicating meters should be observed at regular intervals, five minutes being a common and convenient choice, and the readings noted. At the same time speed of the motor should be taken with a tachometer, if one is available, or with a common revolution counter, and the load conditions should be noted. understanding of the operations and functions of the driven machinery are needed in order that important facts may not be overlooked. The data to be secured include number and kind of driven machines, as well as their important specifications, room temperature and conditions. Anything abnormal, such as scarcity of help, lack of raw material, poor layout or condition of machinery, method of lighting, lack of supervision, etc., has a decided effect upon production and must be noted if full utilization of tests is desired or looked for. Friction and shafting load are important items.

Method and order are of importance in setting down the readings and data taken and will facilitate analysis and deduction of important points. This refers particularly to the test report which will have to be made from the observed readings and data. The first step in making up the test report will be to determine a form to be used. The readings, corrected to their true value, may then be set down in definite sequence. A form found satisfactory in practice is shown in the accompanying table.

TEST NO. 52, ——— MANUFACTURING COMPANY, APRIL 14, 1911.

Time.	Volt.	Amperes.	Kilowatts.	Electric Horsepower.	Revolutions per Minute.	Temperature.	Frames in Use.
6.50	573	120	80	107	....	90	12–3–4
.55	582	102	74	99	796	...	13–5–4
7.	579	95	62	83	....	99	13–5–4
.05	570	100	61	81	796	...	13–4–4
.10	573	96	64	86	....	107	12–4–3
.15	558	104	66	88	793	...	14–5–3
.20	540	110	70	94	....	115	13–5–4
.25	579	98	68	91	796	...	13–5–4
.30	576	103	68	91	....	122	14–6–4
.35	573	92	64	86	807	...	13–5–4
.40	564	100	67	90	....	128	13–5–4
.45	561	98	66	88	790	...	13–5–4
* * * *	* * *	* * *	* *	* * * *	* * * * *	* * *	* * * * * *
10.50	570	77	54	72	....	151	12–0–4
.55	564	85	58	78	802	...	12–3–4
11.	561	86	56	75	....	152	11–4–4
.05	573	93	62	83	790	...	11–4–4
.10	576	90	58	78	....	152	12–5–4
.15	570	94	64	86	785	...	13–6–4
.20	567	96	66	88	....	155	13–6–4
.25	567	100	66	88	775	...	13–6–4
.30	564	104	65	87	....	155	13–6–4
.35	564	105	68	91	785	...	13–6–2
.40	567	100	62	83	....	159	14–5–2
.45	564	96	62	83	808	...	12–4–2
.50	564	76	50	67	....	159	11–4–1
.55	570	60	42	56	795	...	7–4–0
12.	558	50	38	51	....	157	4–4–0
Max.....	585	120	80	107	815	159	14–6–4
Min.....	540	50	38	51	761	...	4–4–0
Aver.....	570	90	60	81	797	...	11.5–5–3.3

Motor No. 1 (General Electric Company, No. 64204).
550 volts, 75 amp, 75 hp. three-phase, 40 cycles, Class 6-75-800.
Type I, Form L.
Location:—No. 1 Spinning Room.
Load:—
15 Whitin Spinning Frames,
256 Spin., No. 24 Warp Yarn.
6 Fales & Jenks Spinning Frames,
208 Spin., No. 7 Warp Yarn.
4 Mason Spinning Frames,
176 Spin., No. 24 Warp Yarn.
Weather:—Cloudy and damp. About 50° F.
Room Temperature:—Rose uniformly from 69° F. to 82° F. Temperature at motor level 2 to 7 degrees higher.
Humidity:—78% to 85%.
Spin. Speed (average), 8,000 Whitin & Mason, 5,000 Fales & Jenks.
Spin. per electric horse-power, 56.
Shafting takes electric horse-power (see Remarks).
Load Factor:—79%.
Remarks:—
There is a peculiar fluctuation in the power taken by this motor which prevented close reading of meters and made it difficult to get good graphic curve. The fluctuation was most marked with shafting only running.
Speed variation due to waterwheels being overloaded and steam-driven unit used at times to bring speed up.
Total time lost in making repairs to frames equal to 1½ frames stopped for entire period.
No second-hand in room during test.
Supply of roving small and insufficient.
Load-factors for Saturday and Monday mornings following this date were 67% and 72% respectively. Corresponding loads in electric horse-power were 76.2 and 80.7.
Column headed "Frames in Use" shows the number of frames of each make in use at each interval in the order noted under "Load."

Load conditions may be considered to be number and kind of machines in actual use in a group drive or the variable conditions affecting the result on an individually driven machine. The temperature of the motor should be taken at regular intervals, which need not correspond with the intervals chosen for the other readings. All readings, except temperature, should be taken at as nearly as possible the same instant after each interval. A fair approximation is made possible by practice.

The duration of the test should be sufficient to admit of striking a fair average from the readings taken and to permit of a good recording curve. In general, a full morning or afternoon run, giving about five hours, will furnish excellent results, but in certain cases it is preferable to choose the time covering one or more complete cycles of operation.

It is of the utmost importance that all data bearing on the test should be taken at the time. Nothing is more exasperating than to find essential information lacking in an otherwise full and complete test report. Knowledge and

The corrected readings are set down in vertical columns opposite the time at which they were taken and other values, such as horse-power and power-factor, figured from them. At the bottom of each column are noted the maximum, minimum and average values found in that column, thus serving to show very quickly the important facts. It may be noted that the quickest method of figuring the average is to assume a figure which a glance down the column will indicate to be approximate and then to add or subtract the difference between this figure and the readings, each in turn, to obtain an amount which, divided by the number of readings, will give the difference between the assumed and actual average value.

The heading of the report gives sufficient information to identify the particular test, and the further data obtained are set down at the right of the readings. Analysis of the data should be carried far enough to deduce the facts of immediate interest and value, the character of these being determined by the purposes of the test, which may relate more particularly to the behavior of the motor or to the

characteristics of the load or other matters of interest. Further analysis may be made later if desirable or if additional information is required.

It will be of interest to glance briefly over this report and note what information it contains. As the heading indicates, it is one of a series made in a particular plant. The motor rating is given in full and it may be noted that the motor records in this plant cover the entire history of this motor. The excess of current in proportion to power developed shows the motor not to be in first-class condition. This is further confirmed by the existence of a fluctuation in power consumed so rapid and violent that it was only with difficulty that the recording wattmeter could be adjusted to give a readable curve. As the action was even more violent when the motor was running light, it is evident that the fault lay in the motor itself. Temperature readings show that in spite of the defect the motor was still usable and could, in fact, have carried a larger load safely provided that the fault were not so localized as to throw an excessive strain on some particular part of the windings. The average voltage, being slightly high, indicates a supply circuit amply large. Neither the average value nor the extremes vary enough from normal to have an injurious effect upon the motor or its operation.

Speed of the motor varied over somewhat wide limits and, in explanation, we find a note to the effect that a steam-driven generator was used at times when the water-power was insufficient to carry the connected load to speed, and it may easily be inferred that the steam-driven unit was not used until the waterwheels had actually gone below normal speed. The variation was of consequence rather as

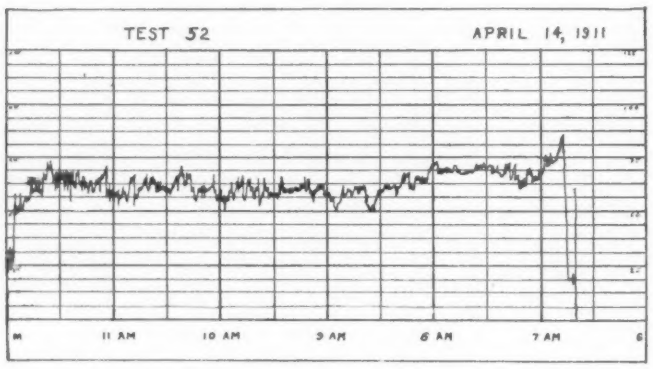


Fig. 3—Recording Wattmeter Chart.

affecting the quality and quantity of the product than as being injurious to the motor.

The load carried by the motor is described somewhat briefly. As several makes of spinning frames were included, it would be difficult or impossible to analyze the power requirements of each separately, but an average showing the number of spindles driven per horse-power has been computed. This is the usual basis of comparison between the power requirements of various spinning frames. Power consumed by the shafting is not noted because of the defect mentioned, which made an accurate determination impossible. It would be an important item to know both in order to judge whether the amount of power so used was excessive and also to determine, at least roughly, the amount of power lost per frame because of the method of driving, which value would serve as a basis of comparison with individually driven frames.

It is generally preferable to include losses in motor and shafting when determining the power requirements of a given installation, since thus all power which must be paid for—whether the power be generated or purchased—may be determined. The percentage of electric horse-power input to the motor corresponding to the motor efficiency will determine the power required by the driven machinery alone if that information is required. As may be inferred, electric horse-power input to the motor is the standard unit adopted for power in the series of test records of which this forms one.

The load-factor or percentage of time machinery was in use during the test is important. It is derived with fair accuracy by dividing the number of frames in use at each five-minute interval by the total number of frames. The load-factor proper for spinning frames may be taken from published figures or calculated for a given set of conditions and a comparison with the observed amount shows how fully machinery is being utilized. Special conditions contribute to a low factor in the test shown and we find noted: (1) Several machines under repair, (2) lack of oversight, (3) lack of raw material. Load-factor is of value not only as indicating the efficiency at which a department is being operated, but also as indicating whether the load on the motor may not be increased by a more intensive utilization of the connected machinery. In connection with other tests it indicates the normal percentage of use of intermittently operated machinery, a figure of use when determining motor sizes for extensions and changes.

Important information, not otherwise discoverable, may be noted during a test owing to any abnormal condition being immediately indicated by the meters, whereby investigation may be made at the time when the cause is most evident. Defects not suspected may thus be brought to notice.

The recording wattmeter chart, shown as Fig. 3, is a most valuable portion of the test record. While it is true that meters may and do have inherent faults and weaknesses, they are, on the other hand, far more accurate and reliable than human observers. Thus they serve to check the results obtained by observation. A further check is afforded by the use of a watt-hour meter, though it was not availed of for this test.

Test records may have a value for future reference exceeding their immediate use. Tests such as described may be considered as standards of reference to be supplemented by simpler tests from time to time. Their value depends largely upon the ability of the tester and his recognition and record of important facts concerning the motor-driven machinery and general conditions. Familiarity with the uses and peculiarities of meters is always desirable and often essential. Curves drawn by recording meters vary according to the characteristics and adjustment of the meter and may be misleading. Accuracy of the meters may, and should, be assured by frequent checking and calibration. Errors due to improper use must be guarded against by the tester.

Having made tests to serve as standards, other simpler forms of testing may be employed to note variations and, in particular, to note a falling off in manufacturing efficiency due to defects in machinery or labor. A very excellent method of continuous testing is found in the use of a recording meter, which may be connected to various circuits in rotation and serve to show variations, which, if sufficiently marked, may be further investigated. This method may not be fully and economically available in an installation comprising a large number of small motors and may be supplemented by readings taken on the various motors with an indicating wattmeter or ammeter. For rapid work of this kind an ammeter is far more convenient than a wattmeter and serves to show variations quite as accurately. Defects in individually driven machines may be located when an inspection of the machine discloses nothing wrong.

Electrical meters are of value for other forms of testing. The actions and operation of particular machines may be analyzed and the structure and design requiring least power determined. The effect of variations may be studied with accurate results—that of dynamometer testing—is in practice difficult and costly. Misconceptions exist regarding the actions of machines in common use. A case may be

cited in the spinning frame, familiar to all cotton-mill men. Roughly quantitative tests show that power supposed to be consumed by the weight and motion of various parts is due to the resistance of the air to the motion of the product —yarn—through it. In an ordinary case air resistance absorbs an average of 10 per cent and a maximum of 20 per cent of the total power required, these figures being conservative.

These amounts are hardly negligible and yet they are only coming into general knowledge among spinners through tests made by electricians. It may be noted in passing that exact tests on spinning frames demand a regulation of conditions very difficult to obtain, and that the difficulty of obtaining exact results is added to by the large number of bearing surfaces, the frictional resistance of which decreases for some time after starting. The variations occurring can, however, be followed more closely with the aid of electrical meters than in any other manner.

Another type of meter deserves mention, although it may be considered electrical only in that it employs electricity to overcome a mechanical difficulty. The meter comprises a drum driven by suitable clockwork and carrying a paper chart (ruled to correspond with time) on which one or more pens rest and draw a line or lines which are interrupted or changed in position by the action of electromagnets in unison with the starting and stopping of a particular machine or machines. The meter will, therefore, indicate during what times the machines connected to it were in use. Obviously, it might have been employed in the test outlined above to have relieved the tester of a part of his observations and have given a more accurate result. Its value is considerable in the case of certain intermittently operated machinery, such, for example, as looms, pickers or spinning frames in a textile plant. It would be of more utility than a recording wattmeter placed in the foreman's office and connected by him to different machines in turn—a plan which has been suggested as a feasible one.

Although tests may be made to determine the conditions under which a motor is being operated, it should be remembered that the motor is entirely secondary to the driven machinery. It is only the means by which power is applied where needed. While it is important and essential to know if the motor is being operated and is operating properly, the economically important facts deduced from tests concern the driven machinery. When only a limited range of information is called for the tester must judge whether further information, necessarily acquired, shall be reported and to whom. At the present time it is rare that the full inherent value of electric-motor testing is recognized or utilized.

TESTING POLYPHASE METERS.

Instructions for Central-Station Testing, Using a Rotating Standard.

By W. O'D. Ryan.

Probably the most convenient method of testing polyphase meters is to connect the series coils in series and the shunt coils in parallel and test as a single-phase meter. With this arrangement it is necessary to halve the constant of the meter under test. The connections for checking one type of three-phase, three-wire meter by means of rotating standards in the manner described is shown in Fig. 1. If the connected load is used and consists of induction motors, care must be taken that the phase relation is not reversed; thus, in Fig. 2, the wire removed from the upper left-hand binding post must connect to 1 on the right to preserve the same phase relation as in Fig. 1; otherwise the motors would be reversed.

In testing polyphase meters furnished with series transformers the 10-amp coil of the standard is used unless the secondary current is first measured by inserting an ammeter and is found to be within the capacity of the 1-amp coil. The 1-amp winding should not, however, be

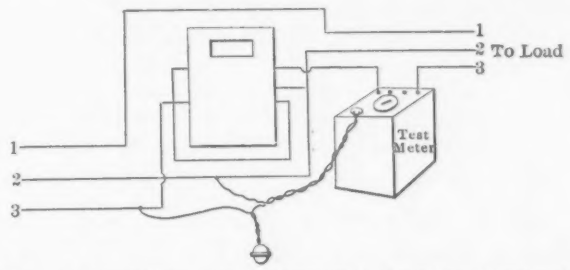


Fig. 1—Connections for Testing with Rotating Standard.

used except where control of the load is possible. In the case of switchboard meters it is safest always to use the 10-amp winding, as a sudden increase of load might result in injury to the 1-amp winding. Where series transformers are used one transformer must be short circuited and disconnected from the meter when testing with coils in series. The constant of the test meter must be multiplied by the series transformer ratio. If both series and shunt transformers are used the constant of the test meter must be multiplied by the product of the raito of transformers.

As an example, suppose it is required to test a 150-amp, 2300-volt, three-wire, three-phase meter, series transformer ratio, 40:1; shunt transformer ratio, 20:1; disk constant of meter, 300.

Connecting the coils in series the disk constant becomes 300/2, or 150. Using the 10-amp, 110-volt coil of the standard meter, the constant of which is 0.6, the testing constant of the standard becomes $0.6 \times 40 \times 20 = 480$. The percentage of accuracy will then be the quotient, revolutions meter under test $\times$ 150/revolutions standard $\times$ 480.

Polyphase meters with series and shunt transformers may be tested without transformers, but in this case the disk constant must be divided by the product of the ratio of transformers. If polyphase meters with series transformers are tested on one phase at a time, then the series transformer on the phase not being measured should be short-circuited, the potential circuits being left connected.

The rotating standard may be used to calibrate either Westinghouse, Fort Wayne or Stanley meters, it merely being necessary to determine the watt-hours per revolution of the disk of the particular meter to be tested, and to use

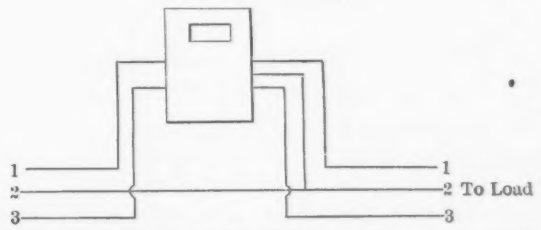


Fig. 2—Connections of Three-Phase, Three-Wire Meter.

this figure as a multiplying factor in the same manner as the constant is used on General Electric meters when checking them with the standard meter.

In calibrating or testing, the constant of all General Electric meters denotes the number of watt-hours per revolution of the disk. Other manufacturers do not all express the constants of their meters in the same manner. When otherwise expressed it becomes necessary to find

the watt-hours per disk revolution of the meter to be tested in order that it may be calibrated by the standard in the same manner as General Electric meters.

This factor can be readily determined from the testing constant of the meter. Thus for Westinghouse meters divide the testing constant by 3600, and for Fort Wayne and Stanley meters divide the testing constant by 36. If k denotes the testing or calibrating constants and x the watt-hours per revolution of the disk, then:

$x = k/3600$ for Westinghouse meters.
$x = k/36$ for Fort Wayne meters.
$x = k/36$ for Stanley meters.

Having found the number of watt-hours per revolution of the disk of the meter to be calibrated, one proceeds in the same manner as when calibrating General Electric meters, using the factor x as a constant. When the meter is correct the revolutions of the standard meter multiplied by the constants are equal to the revolutions of the meter under test multiplied by x and the ratio of these quantities gives the per cent accuracy.

The testing constant of type A, two-wire Westinghouse meters is volts $\times$ amperes (as marked on the dial or counter) multiplied by 1.2. For type A meters with series transformers, but tested without them, the testing constant is volts as marked on counter multiplied by 6, since these meters are 5 amp ($5 \times 1.2 = 6$). For type A meters with series and shunt transformers, but tested without them, the testing constant is 600. For type A meters tested with series and shunt transformers multiply the constants as found above by the ratio of transformers. For polyphase type A meters with series and shunt transformers, but tested without them, the testing constant is 1200. For three-wire, single-phase type A meters the testing constant is volts $\times$ amperes, as marked on the counter, multipled by 2.4.

The testing constants for type B and C meters are found in the same manner as for the type A meters except that the volt-amperes as marked on the dial must be multiplied by 2.4 instead of 1.2.

The testing constants of Fort Wayne meters are given in the instruction book furnished by the Fort Wayne company. Until recently the constants were not marked on the meter itself. However, in meters now being shipped the testing constants are marked on the cup.

The constants for Stanley meters are marked on the cover and denote the seconds per revolution for 100 watts.

The accompanying tables give the watt-hours per revolution of various sizes Westinghouse, Fort Wayne and Stanley meters.

WESTINGHOUSE METERS—TWO-WIRE.

	Type A.		Type B.	
Amperes.	100 Volts.	200 Volts.	100 Volts.	200 Volts.
5	.166	.333	.333	.666
10	.333	.666	.666	1.33
20	.666	1.33	1.33	2.66
40	1.33	2.66	2.66	5.33
80	2.66	5.33	5.33	10.66

FORT WAYNE METERS.

Constant.	Watt-Hours per Revolution.	Constant	Watt-Hours per Revolution.	Constant.	Watt-Hours per Revolution.
9	.25	90	2.5	360	10.0
18	.50	108	3.0	432	12.0
24	.66	144	4.0	576	16.0
36	1.00	180	5.0	720	20.0
54	1.50	216	6.0	864	24.0
72	2.00	288	8.0	900	25.0

STANLEY METERS.

Constant	Watt-Hours per Revolution.
20 Sec.	.555
30 "	.833
45 "	1.25
60 "	1.66
90 "	2.50
120 "	3.33

THEFT OF ENERGY.

A New Means of Guarding Meters Against Magnetic Tampering.

Many watt-hour meters can be made to register slowly, or even to stop, by bringing near them a strong magnetic field. A device to give knowledge of such fraudulent registration, either by interrupting the service or operating an indicator within the meter, has been invented by Giacomo Berardi, of Genoa, Italy, and was patented by him in the United States Aug. 1.

As shown in Fig. 1, the detector device consists of a small spring-suspended soft-iron bar B which normally hangs in the center of a contact loop L. Several of these detectors are recommended to be placed within the case of the meter so as to guard it from all sides. In the presence of any thin magnetic field that may be imposed upon the instrument for illegitimate purposes, the bars will be deflected, swinging so as to make contact with the surrounding loops. The shunt circuit thus established has its path

Figs. 1 and 2—Arrangement of Detector Device.

completed through a capsule of powdered graphite and calcium carbonate (C, Fig. 2), the resistance of which causes the generation of heat sufficient to melt a piece of lead wire, releasing a set of contacts and opening the main circuit at S. Another modification operates to throw over an arm, indicating that the meter has been magnetically tampered with.

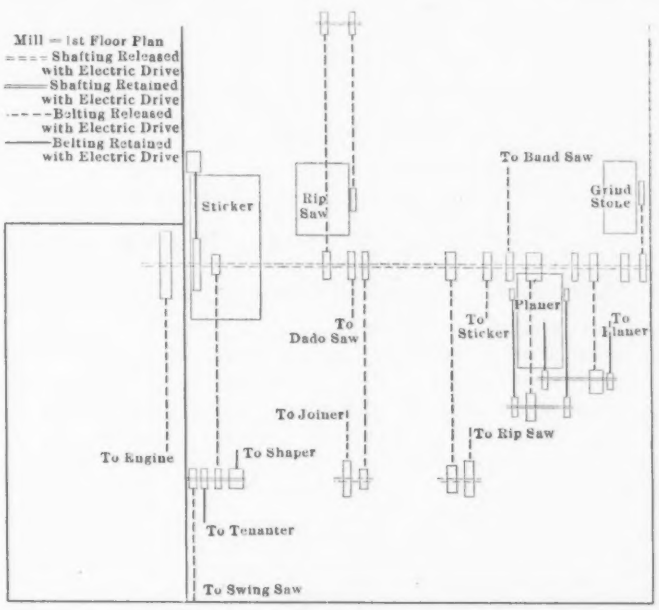
Where desired, the inventor also provides a method of utilizing the magnetic action of the detector shunt current to work the main-circuit switch, instead of using its heating effects as first described. A solenoid switch is arranged with a high-resistance winding of copper and German-silver turns, which normally bridge the closed main switch contact. When the detector acts its shunt circuit is closed through the solenoid winding, magnetizing the latter's floating core, which is caused to come up with a hammer-blow action, opening the main switch contact. These contacts are then held open continuously by the diminished current deflected through the winding, due to the switch being open. To restore service after the external magnetic influence has been removed the main line switch must now be opened, de-energizing the solenoid and permitting its contact to fall closed by gravity, after which operation may again proceed normally. In the powder-and-fuse modification, the inventor explains, the resistance-

powder mixture can be adjusted to give any desired degree of sensitiveness, so that service will not be interrupted by seismic disturbances, passing magnetic fields or other causes resulting in the detector bar being momentarily swung against its contacts.

THE ELECTRIC DRIVE IN A LUMBER MILL.

An Analysis Showing the Saving Through the Replacement of Steam by Electricity.

No better illustration can be given of the advantages of the electric drive than in cases where it forces competing motive powers out of business in the face of unusually low fuel costs. Through the courtesy of Mr. B. W. Mendenhall, commercial agent of the Utah Light & Railway Company, of Salt Lake City, the following particulars are given of the successful introduction of the electric drive in a representative lumber mill, the adoption of electricity having been effected on the basis of a lower operating cost per year than the original steam plant of the concern was capable of meeting, even when refuse sawdust and shavings were burned under the boilers. The Utah Light & Railway Company made a careful investigation of the operating costs in the case in hand, submitting an engineering report in which the power consumption, present and estimated costs were reviewed, including a diagram of the premises.



Plan of Mill.

showing the shafting and belts released by the introduction of electric driving.

The central-station organization pointed out that the ideal arrangement for the use of electric energy is a separate motor for each machine, but suggested that when the energy saving by this method ceases to pay at least 15 per cent on the investment it is not a success from a strictly financial point of view, although the cleanliness, convenience and flexibility of such an installation sometimes make it more desirable. The conditions at the plant did not appear to warrant the exclusive use of the individual drive. The arrangement suggested and which was followed in the lumber plant was as follows:

On the first floor of the mill the machines, all individually driven at a motor speed of 1700 r.p.m., were: Rip saw, 5 hp; planer, 10 hp; 12-in. sticker, 10 hp; swing saw, 3 hp.

On the second floor the machines were: Individually driven—Planer, 7.5 hp; 6-in. sticker, 5 hp; rip saw, 5 hp; joiner, 3 hp; dado saw, 3 hp; motor, 1700 r.p.m. each; band saw, 3 hp; motor, 1120 r.p.m. Group-driven—Tenoner, shaper and mortiser, 5 hp; sander, emery wheel and grindstone, 5 hp; both motors, 1700 r.p.m. All motors offered were of the three-phase induction type, wound for 220 volts, 60-cycle service. The motor ratings were selected on the basis of making sure that the size was adequate for the service, without danger of insufficient power at any given machine.

Careful tests of the power requirements of the steam-driven establishment showed the following demands:

Maximum load on day of tests	20 hp
Average total load on day of test	8.8 hp
Friction load on day of test	5.5 hp
Average total productive load on day of test	3.3 hp

The average total productive load, if the machines had been fully loaded during the entire time on the test date, not including the 5.5 hp of friction, would have been 7.96 hp. This figure was used in the cost estimates which drove the steam engine from the plant, rather than the actual average productive load. From the records of the lumber company the following yearly costs of steam power were deduced for two successive years: First year, $1,176; second year, $1,366, giving an average of $1,271, or $106 per month. The principal items were coal (required in addition to sawdust and shavings), average $600 per year, and engineer's wages, average $526 per year, other smaller items being oil, waste, packing, engine repairs and miscellaneous. None of these smaller items much exceeded $40 per year individually.

COST OF ELECTRICAL OPERATION.

The average load used in the estimated cost of electric service was based on the supposition that all machines in use during the day of test were operated at their maximum capacity for the entire time that the machines were in service. As the machines were only operating under maximum load for approximately 50 per cent of the time that they were in operation, a large factor of safety was apparent in the estimated cost of electrical service.

The average load of 7.96 hp-hours per day, with twenty-six days' service per month, was 1240 kw-hours, and at 4.6 cents per kw-hour the energy cost was $57.10 per month, to which was added oil at $1.50; so that the total yearly cost of electrical operation was $703, compared with $1,271 for steam. The estimated saving by the use of electricity was $568 per year, and this led to the installation of the motor drive.

The old steam plant was given additional advantages in determining the relative yearly cost of operation, and still electricity won the day. Thus, the electrical costs were figured upon a total operation of 312 days per year, against an actual service by the old steam plant of 256 days. The average number of workman-hours with steam drive was 24.5 per day, while with electricity this came to 36. The estimated cost of motors was $1,219 installed, the cost of placing the motors at the mill door being $1,080, material to be used in the installation work $108 and labor of wiring $31. The costs of pulley bushings, labor and material for motor platforms and the erection of motors were not covered. A special point was made of the fact that the only item which would be lost in case the factory moved would be the labor charge for installing the wiring. Another point in favor of electricity was that the old steam plant was fast approaching a period of costly repairs, which would be forced upon the owners if a reasonable efficiency of operation was to be assured.

The installation of the electric drive resulted in the elimination of the main shaft and three auxiliary lines of shafting, besides cutting out fifteen belts of varying length and size. The results of the first year's operation were as follows:

Total cost of energy	$419
Maximum bill for any month	$55
Maximum kw-hours for any month	920
Minimum bill for any month	$33
Minimum kw-hours for any month	220
Maximum demand, hp	16.5

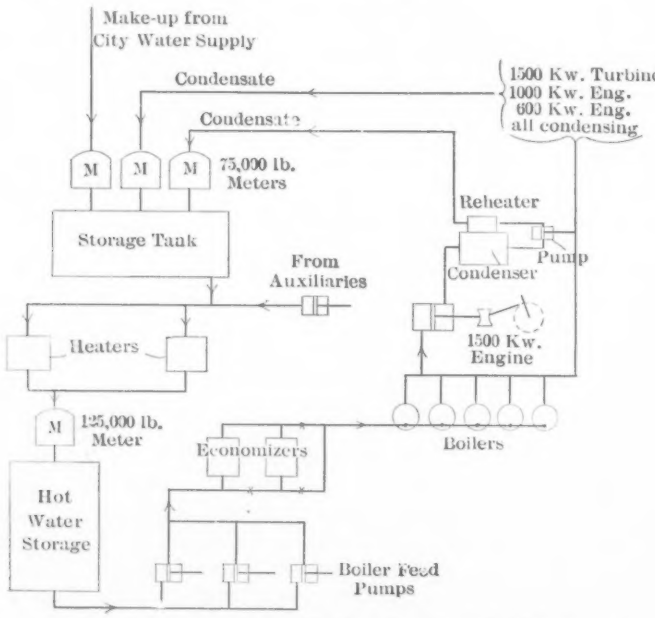
The installation operated at full capacity during only one month of the year. Under normal conditions the power bill will run between $55 and $60 per month. In spite of the availability of shavings and sawdust at zero cost the introduction of electricity has cut the expense of operating the mill by over 50 per cent.

CONTINUOUS STEAM TEST OF A CENTRAL-STATION PLANT.

Practical Value of Metering All Water Used by a Condensing Steam Plant.

Conditions approximating a continuous plant test are made possible in the station of the St. Joseph (Mo.) Railway, Light, Heat & Power Company by the provision of water meters in the boiler-feed lines, as well as in the make-up supply pipe and the return lines from the condensers serving the various engine and turbine units. The accompanying sketch will make a detailed description of this piping layout unnecessary.

The water meters used are of the Hammond float-discharge type, comprising two vessels which are alternately filled and emptied by the float-controlled valves. The large totalizing meter, which can measure 125,000 lb. per hour, holds 2000 lb. of water per side. The smaller meters on the make-up and condensate-return lines are each capable of measuring 75,000 lb. of water per hour and hold 1250 lb. per side. All of these meters are located in the boiler-room in more or less inaccessible places, but by means of



Arrangement of Apparatus for Continuous Metering of Water in St. Joseph Power Plant.

electric contacts are closed each time the meters' trip-counting dials are operated in the engine-room, where a direct reading of the quantity of water being used can be obtained at any time.

At present the condensate returned from the condenser of the 1500-kw Curtis turbine and one 1000-kw and one 600-kw engine unit is collected into a common storage tank and returned through a single meter, while the 1500-kw engine has its own separate meter. A separate meter is now being provided for the turbine, so that its performance can be watched more closely. Tests can be made on any unit under the present layout, however, by manipulating valves, so that the condensate of only the unit under test is returned through the meter, the other being by-passed directly into the storage tank.

City water is used to make up the losses in the condensing system, which have averaged slightly less than 15 per cent. When the notoriously muddy Missouri River is sometimes fairly clear this raw water is used directly for boiler-feed purposes.

The three smaller meters are mounted over the storage tank, which is supported on the boiler-room roof trusses. The feed-water heaters are of the open type and are operated up to 7 lb. pressure. The totalizing meter normally receives water at about 180 deg. Fahr., although this temperature may fall very low when the heaters are not in use. The water meters are warranted to be accurate within 2 per cent, and it is found that, due to the compensative expansion of both the water and metal vessels, this accuracy is practically unaffected by temperature. The economizers are arranged for series or parallel-flow operation of both gases and water.

The practical value of such a meter installation has proved important in the case of the St. Joseph plant. Continuous figures on the quantity of water purchased, water evaporated and steam used by each unit are now available, and these have indicated the points where steps to improve operating efficiency have been taken. The boiler evaporation was found low, and these units are accordingly to be pushed. The prime-mover units which are giving the best performance have now been determined and the less efficient ones are being reserved for peak-load operation. The entire plant is operated at a steam consumption of 26 lb. per kw-hour, including all auxiliaries, boiler blow-offs, etc. The most efficient unit on the floor, the 1500-kw engine, has been found to take only 22 lb. of steam per kw-hour.

Mr. A. J. Purinton is general superintendent of the St. Joseph Railway, Light, Heat & Power Company, Mr. H. A. Cowgill is electrical engineer and Mr. R. A. Foresman is the engineer in charge of the power plant.

UNDER-WATER COAL STORAGE.

Submerged 10,000-Ton Coal-Storage Pit at Omaha.

At Omaha in the past strikes of coal miners have proved as expensive to power-plant operation as in the experience of many other cities. As is well known, coal in dry storage even six months will lose as much as 25 per cent of its fuel value, while its tendency to spontaneous firing is an additional source of trouble. For these reasons, unfortunately, it does not pay to keep large quantities of fuel continually in stock to guard against possibility of strike shortage, while, on the other hand, the matter of acquiring a large coal reserve quickly becomes a problem after the first rumors of a strike are abroad.

Coal can be stored under water, however, almost indefinitely without loss of its fuel value. This has been well proved by tests, and such under-water storage, it will be seen, offers an opportunity for holding large coal reserves almost indefinitely against a time of need. With this idea of guarding against strike shortage, following a recent expensive experience, the Omaha Electric Light & Power Company is just completing the installation of a great under-water storage pit capable of holding 10,000 tons, with the bunker contents enough for three months' operation of its 13,000-kw plant.

This submerged storage pit, as shown in the accompanying illustrations, measures 100 ft. x 116 ft. in plan and is 22 ft. deep below the water level, which is in turn 23 ft. below the crane runway. It will submerge 7000 tons of coal, while 3000 tons more can be piled on above the water level. The coal is unloaded from cars run alongside the pit by means of a grab bucket carried on a crane of 145-ft. span. The coal-car track passes directly above the hoppers leading to the coal crushers, which in turn discharge into the conveyors, elevating the fuel to the overhead

bunkers. This arrangement provides that the ordinary route of the fuel is from the cars to the boiler-room, the storage pit always being kept filled with a fixed quantity of coal.

The storage pit is of reinforced concrete and is carried on nearly 400 piles at 5-ft. centers driven to bed rock 19 ft. to 30 ft. below the semi-liquid quicksand. The presence of this quicksand made it necessary to reinforce the structure for both internal and external pressures to prevent collapse of the pit when empty. The piles are capped with 2-ft. 6-in. concrete slabs, reducing the stresses in the pit floor, which is 12 in. thick.

Besides the steel reinforcing in the floor, old rails have been embedded in the concrete at 1-ft. distances, their heads being flush with the waterproofed floor surface, to serve as an armor against the impact of the bucket when removing coal from the pit. These rails and the pit forms and interior are well shown in Fig. 3.

The side walls are 4 ft. thick at the bottom, tapering to 2 ft. 6 in. at the top. The submerged storage has been so constructed as to be capable of extension in both directions as the plant grows.

Spanning the pit and the crusher hoppers, a total width of 145 ft., is the 5-ton bucket crane, made by the Toledo Crane & Bridge Company, and one of the largest of its kind ever built. This crane is made up of two girders 12 ft. apart, between which runs the trolley carriage with its 2-cu. yd. bucket. The bridge is propelled by a 45-hp motor at 300 ft. per minute, and the trolley is operated at a similar speed by a 16-hp motor. The main hoisting is performed by two motors, one of 45 hp and the other of 30-hp rating, giving a hoisting speed of 120 ft. per minute. With this crane bucket a 50-ton car has been unloaded in twenty minutes. The cost of each handling of the coal is estimated to be about 4 mills per ton, whether from car to pit or pit to crusher hoppers.

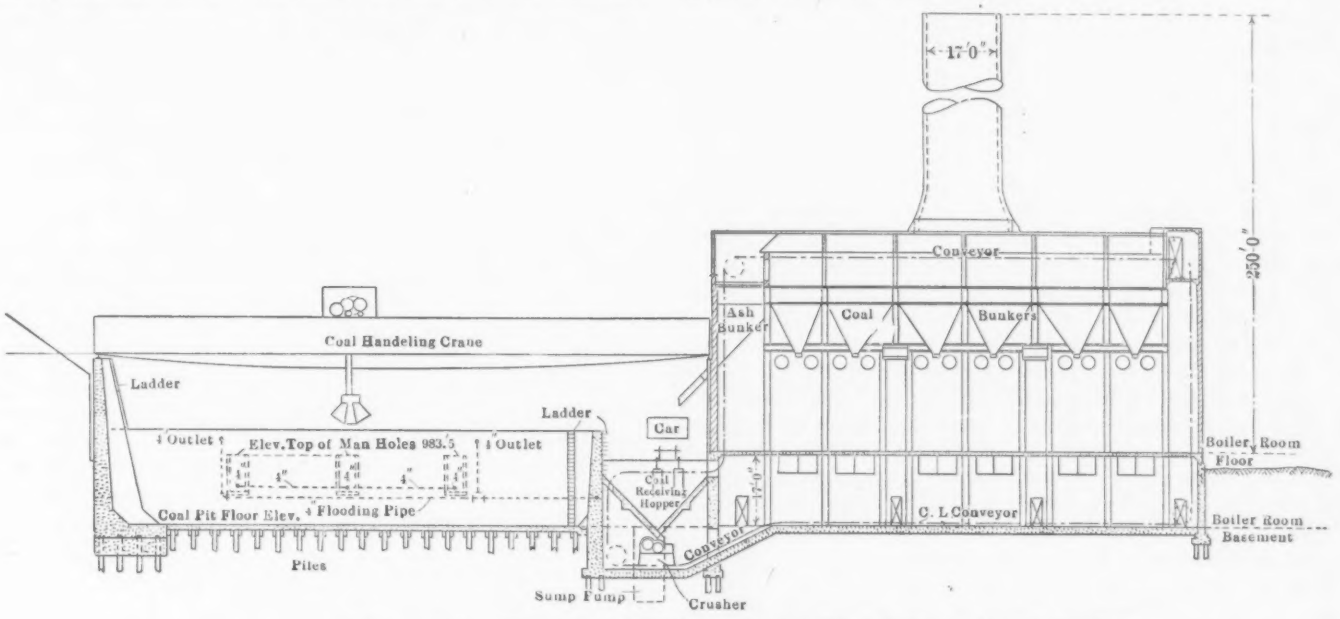


Fig. 1—Section Through Under-Water Storage Pit and Power House, Omaha.

On account of the notorious muddy sediment of the Missouri River, on the banks of which the plant stands, waste water from the plant supply (which has been allowed to settle in sedimentation basins) is used to fill the coal-storage pit. For draining the pit outlets fitted with valves are provided just above the sewer level, so that the water can be drained down to this point by gravity, beyond which the same sump pump used to fill the pit can be brought into service for the purpose of discharging its contents into the sewer.

The Omaha under-water coal-storage pit is estimated to have cost about $70,000, a part of this being due to the unusual and difficult conditions of quicksand on which the pit had to be foundationed.

Mr. H. A. Holdrege is general manager of the Omaha Electric Light & Power Company, and Mr. C. T. Anderson is chief engineer of the power plant. The under-water coal-storage pit was constructed under the designs and supervision of Sargent & Lundy, consulting engineers, Chicago.

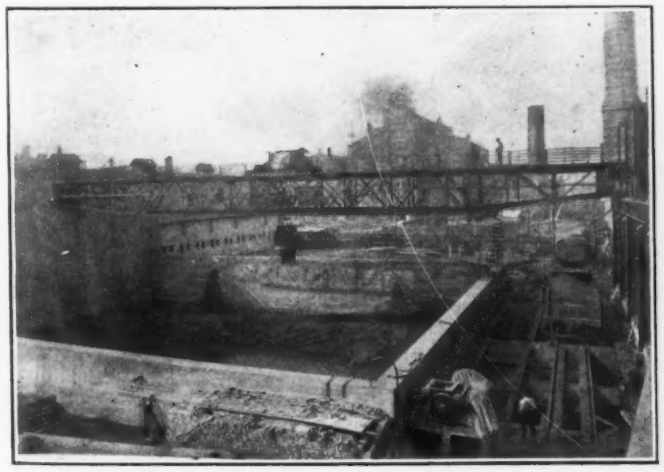


Fig. 2—Crane Bucket Filling Under-Water Coal-Storage Pit from Car.

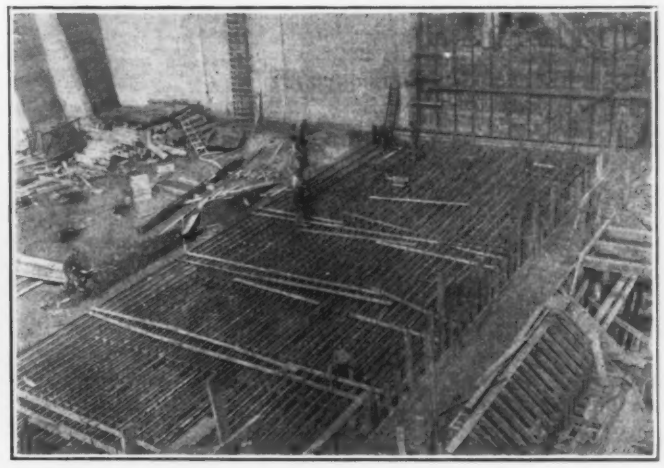


Fig. 3—Floor of Storage Pit During Construction, Showing Old Rails Used as Armor.

LETTERS ON PRACTICAL SUBJECTS

CONDENSATION IN RIGID CONDUIT

It is very generally recognized that in places subject to vapor or dampness the open-knob and tube method of wiring gives better satisfaction than the more expensive rigid-conduit system. Even in the ordinary work where dampness does not exist troubles have been encountered owing to condensation in the conduit. Water-tightness in the conduit is not of necessity desirable, and the writer knows of instances where in vertical runs it has been found best to provide draining outlets. The condensation troubles usually exist in conduit work installed during the winter months and made water-tight. At first there are very few complaints, but after a while instances of shock are reported with certain types of switches. In one case switches with other insulation were substituted, but the remedy was only temporary, the shocks manifesting themselves after a lapse of a few months. The trouble was traced to condensation in the runs and as a remedy every switch box in the run was removed and in its place a box with an extra outlet substituted, the outlet in each case being at the bottom of the box and left unplugged. Where this was impossible a hole was chipped in the bottom of the box. It was surprising to note that with this means of ventilation and drainage all trouble disappeared. In the switches which first gave trouble hard black vulcanite was used for insulation and this absorbed the water of condensation in the conduit. A switch with non-hygroscopic insulation was tried, but there was sufficient moisture in the conduit to form a path for surface leakage. It is safe to assume that if either switch was not connected to the conduit in which condensation took place no trouble would have been found. The inspection bureaus, it is true, require a lead covering over the wires used in conduit when the latter is installed in a damp place and is not water-tight, but their rules would not cover the instances I have in mind where the trouble was traced to condensation in places presumably dry. In the crusade being made in very many places to limit the installation of wires to that inclosed in rigid iron conduit, the question of dampness and condensation is apparently lost sight of. So far as the writer's observations have gone, when properly installed, exposed wiring without conduit is safer than that inclosed in conduit and defects are more readily noted. Its appearance is, however, not as pleasing as a straight conduit job, but where appearances do not count for much, especially in factory and mill work, it is not unusual to find the exposed wiring in highest favor. Oftentimes a combination in which conduit and condulets are employed to protect the circuits from the floor to a point about 8 ft. up the wall and where exposed work is used above this point makes a better installation, conduit being preferable to a wooden box for side-wall protection of the wires. Where conduit is employed on ceilings over ovens or boilers, for instance, the combination of heat and condensation may ruin the insulation of rubber-covered wire. Even if condensation is not present, a weather-proof insulation is better than rubber in such a location.

St. Louis, Mo. FRANK WRIGHT.

VENTILATING FOUNDATIONS.

It is now well recognized that every reasonable expedient should be adopted that will insure a plentiful supply of cooling air for electrical machinery. The manufacturers are utilizing very "open" construction in the machines that they build so that air can have access to the current-carrying parts and keep them cool, thereby enabling maximum duty to be performed with a minimum of material. In some cases fans or blowers that direct streams of air against the active material are mounted on the rotating parts. Even railway motors are arranged for "forced ventilation" so that a maximum output can be obtained from a motor occupying a given space. These examples indicate the importance of arranging all electrical machines so that an ample amount of cool air will circulate around them when they are in operation. Inasmuch as the output of almost all machines is limited by the temperature rises of certain parts, if the air supply is insufficient or of a relatively high temperature, the output will be limited accordingly.

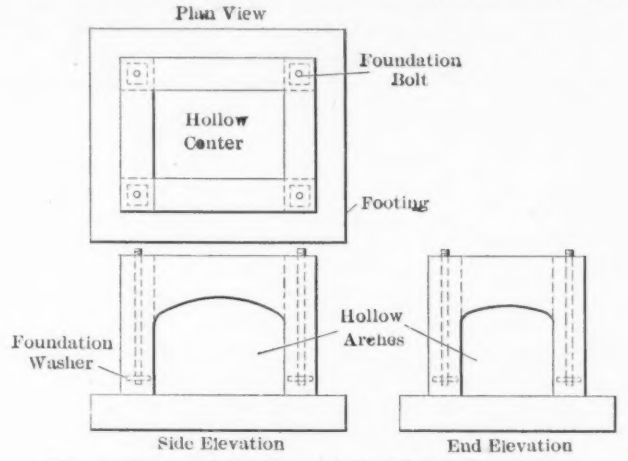


Fig. 1—Plan and Sections of Ventilated Foundation.

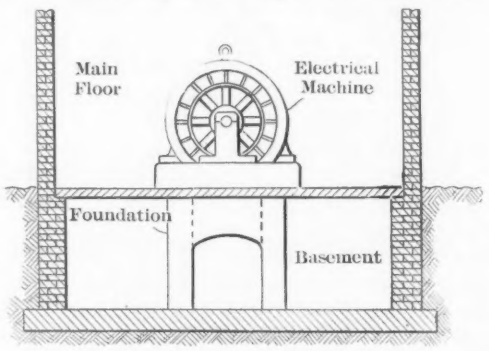


Fig. 2—Ventilated Foundations in Station.

It has long been the usual practice to design the foundations of large engine-driven generators so that the air circulation about them would not be materially obstructed. But in the design of foundations for smaller machines (particularly self-contained ones, such as motor-generators and rotary converters) this feature has frequently been overlooked and in some cases the maximum outputs of machines have been reduced because of the oversight. This article

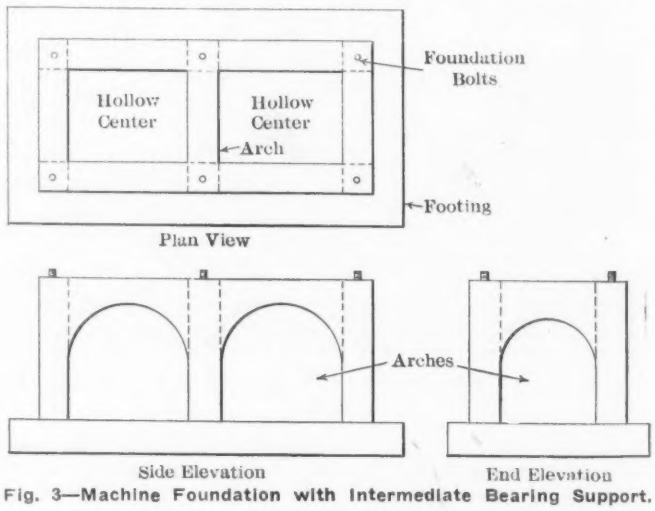


Fig. 3—Machine Foundation with Intermediate Bearing Support.

is written to call attention to some methods of constructing foundations for self-contained electrical machinery that will insure a good supply of cooling air.

One form of so-called "ventilated" foundation is illustrated in Fig. 1. The foundation is hollow in the center

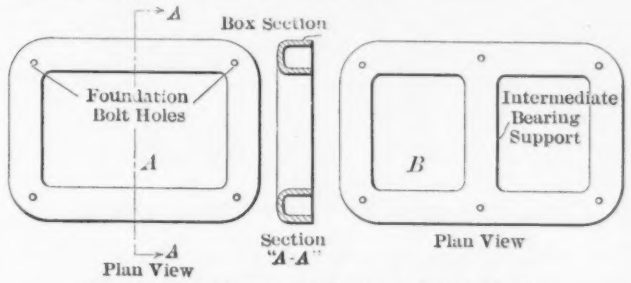


Fig. 4—Plan Views and Section of Bed Plates.

and has arched holes through each of its four sides. It really consists of four arches arranged in the form of a hollow rectangle. The foundation is designed to extend between the basement floor and the main floor of a station as suggested in Fig. 2. It relieves the main floor of the weight of the machine that it supports. The basement should be well ventilated so that cool air will be drawn in and rise into the station as it is heated by the machine.

Besides affording thorough ventilation the foundation of

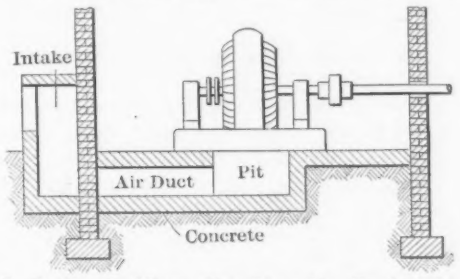


Fig. 5—Sectional View Showing Air Duct Into Pits.

Figs. 1 and 2 is very economical of material. The ordinary practice in constructing a foundation for the application of Fig. 2 would be to build it solid from floor to floor or, possibly, to hollow it out somewhat in the center. With the design of Fig. 1 all of the material that would be wasted in a solid construction is saved. Although this foundation might be constructed of masonry, concrete is probably a cheaper material for most localities. A 1:3:6 mixture

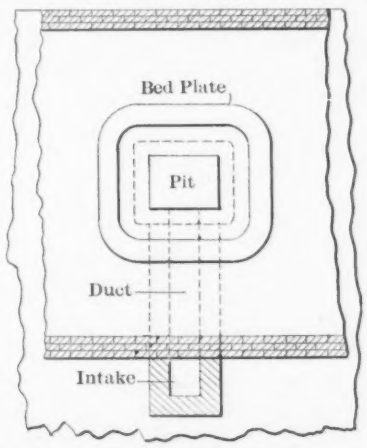


Fig. 6—Plan View Showing Air Duct Into Pit.

poured very wet into substantial wooden forms will provide a thoroughly dependable foundation.

The arrangement of the foundation-bolt holes in the bed plate and the form of the bed plate of the machine to be supported often determine the design of the foundation. The foundation shown in Fig. 1 is arranged for a machine requiring four foundation bolts, while that of Fig. 3 is for one requiring six bolts. The bolts should be extended almost to the bottom of the foundation and should have washers on their lower ends, as suggested in Fig. 1. At *A*, Fig. 4, is shown the plan view of the bed plate for the foundation of Fig. 1 and at *B* is shown that for the foundation of Fig. 3. An arch should always be arranged in a ventilating foundation under an intermediate bearing support (if there is one) in the bed plate, as shown in Fig. 3, so that the support can be firmly "grouted in" to the foundation. If such an arch is omitted difficulties may result from vibration.

It should be noted that where the foundation extends from basement to floor, as in Fig. 2, the footing of the foundation and the floor may be combined, so that in some cases a separate footing may not be necessary, although, as a rule, for a rational design it is necessary to make a concrete foundation footing thicker than a concrete floor.

Inadequate ventilation is often afforded to generators driven by waterwheels. Frequently there is no basement under the generator room, which makes it a little difficult to provide a source of cool air supply. In such cases an air duct from the outside of the building, or from some place where the air is always cool, should be brought into the machine pit, possibly after the manner outlined in the sectional view of Fig. 5 and the plan view of Fig. 6. The pit should be ventilated for both horizontal and vertical generators. The air duct is best constructed of concrete or brick set in cement mortar and should in every case be at least large enough so that a man can crawl through it to clean it or so that, if it is short, it can be readily cleaned with a scraper. Obviously the size of the duct must be reasonably proportional in relation to the capacity of the machine that it supplies with air.

Albany, N. Y. CLARENCE G. MEYERS.

FOLDER FOR FILING ENGINEERING CLIPPINGS.

The writer has experienced the usual difficulties in attempting so to file engineering clippings that they would be readily available. Unless such clippings are filed in such a manner that they can be quickly found when needed they are of little real worth, whatever may be their intrinsic value. After trying a number of different systems a system of envelope files was devised that has proved very useful to the writer, at least.

These envelope files are made by taking a number of envelopes of large size and binding them together with brass paper fasteners in book form. They are bound on the edge opposite the flaps and thin pieces of cardboard serve as covers for the folders. The flaps are then folded inside of the envelopes, thus forming a pocket in which the clippings can be filed.

There is a file, or book, for every main subject and one or more envelopes for each subdivision. The envelopes are given numbers and all the clippings filed in a particular envelope are indexed under that number. In addition to this the clippings in a particular envelope are lettered A, B, C, etc., in the order they are accumulated. On the face of the envelopes is a table giving the titles of the clippings opposite the file letters.

This system of filing has proved very satisfactory, as when it is desired to look up some subject it is possible to turn directly to the envelope containing the clippings on that subject and read off the titles of all the clippings directly from the face of the envelope. It is then possible to pick out the ones it is desired to refer to without going through the whole bunch, as the clippings are put into the envelopes in the order of their file letters.

Kenyon, R. I. H. M. NICHOLS.

TROUBLE WITH AN INDUCTION MOTOR.

Before being called upon to investigate trouble I was informed that a 25-hp induction motor, driving the pump in

an ammonia compression refrigerator system, after a few minutes' operation became hot. It always started up nicely, but after full speed was thrown in the trouble commenced. The windings became hot, the bars in the squirrel cage rotor got red-looking, the speed fell off and then the fuses went. Everything was examined, loose connections looked for, voltage measured, the pumps gone over to see if an overload might not be the cause and, finally, the motor was entirely dismantled. Such was the condition in which I found things.

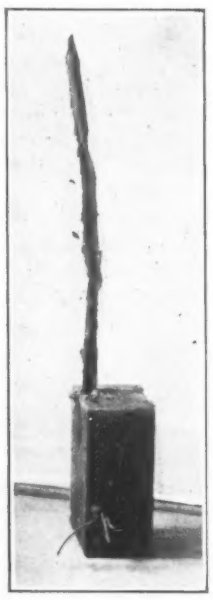
Repeating all the former tests and examining the rotor and trying out phases did not show anything out of the ordinary, so the motor was reassembled. I next gave attention to the auto starter and immediately discovered the seat of the trouble. A sliver of wood about 4 in. long was found floating in the oil. This was removed and the case replaced, when the motor was started again; no further trouble was experienced.

The reason for the previous failure was the fact that the sliver of wood got caught in the contact jaws at the full-speed notch, throwing the motor on single phase, although starting on the three phases. The three phases, being fully loaded under normal operation, one phase naturally could not bear up under its triple duty.

Joseph, Ore. J. J. Rezab.

SHORT-CIRCUIT CAUSED BY FORCING CONDUIT BETWEEN SERVICE WIRES.

The accompanying engraving of a cabinet box and length of conduit shows the results and effects of a short-circuit which was caused by the conduit being forced down between the two service wires that entered the cabinet box through this section of conduit. It will be noted that the conduit is all melted, and had it not been installed in a



Effect of a Short-Circuit on Cabinet and Conduit.

fireproof compartment the short-circuit would have resulted in a very bad fire in one of the local 5-cent theaters. The accident was caused by workmen on the roof stepping upon the conduit, which was run over the roof, forcing it down between the two feeder wires, as mentioned.

Oklahoma City, Okla. H. W. Brunell.

A TRANSFORMER MISCONNECTION.

While it is a simple matter to connect three transformers to a three-phase circuit, the accompanying diagrams will illustrate how equally simple it is to go wrong. Fig. 1 shows a diagrammatically correct delta connection to a circuit, *a, b, c,* the corresponding points on the transformer primaries being numbered as shown. The secondaries are not shown. In this particular instance the

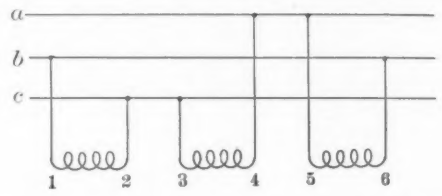


Fig. 1—Diagramatically Correct Delta Connection.

three transformers were set up in a railway substation to step down the voltage and to provide taps for starting the rotary converter from the alternating-current side. An iron-pipe framework was erected above these transformers, which were arranged in a row side by side, and upon these were fastened three heavy wires, *a, b, c,* for convenience of connection. As in Fig. 2, the first trans-

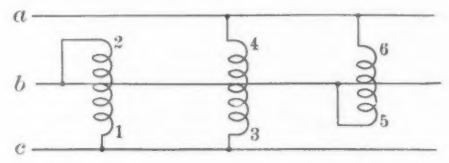


Fig. 2—Misconnection of Transformer.

former has its terminals connected to *bc,* the second to *ac* and the third to *ab.* The terminals were, therefore, run in as short a line as possible to the lines *abc,* as in Fig. 2, a natural mistake if one forgets the polarity. As was to be expected, there was trouble and the circuit-breaker kicked out every time an effort was made to start the con-

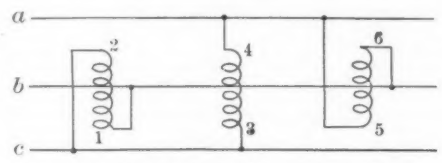


Fig. 3—Proper Connection of Transformer.

verter. By numbering the circuits as shown and checking with Fig. 1 Fig. 3 was obtained, showing the proper, although more lengthy, connection. It is not always convenient to carry such a diagram around or possible quickly to find it should one have it. To construct such a diagram at any time it is only necessary to draw Fig. 4, the

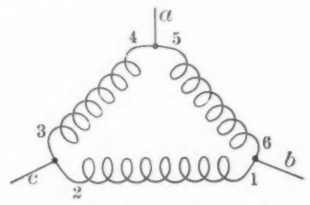


Fig. 4—Diagram of Delta-Connected Transformer.

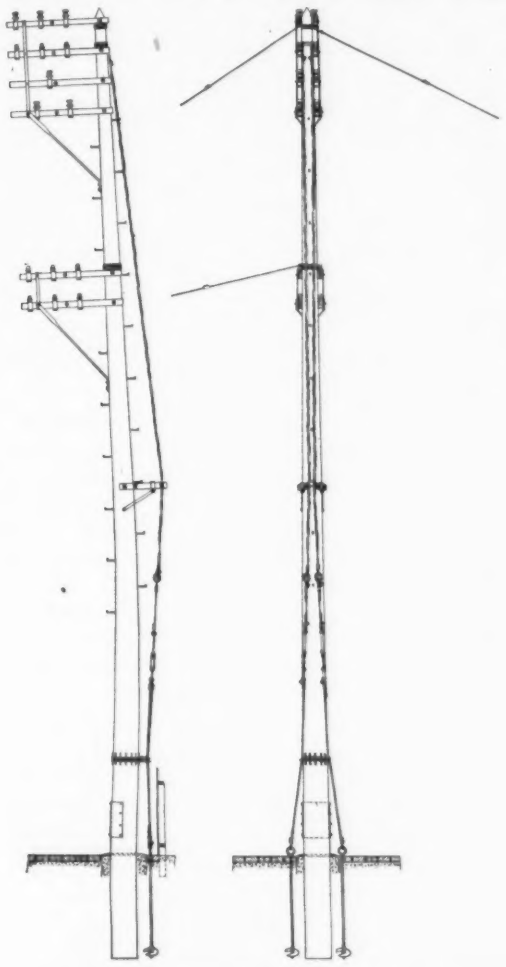
ordinary conventional delta representation, and number the ends of the windings consecutively from one to six. The junction points *a, b, c* will therefore correspond to similar points in Fig. 3.

San Francisco, Cal. R. J. Jenkins.

INCREASED STRENGTH OF POLE BRACED TO GROUND ANCHOR.

The accompanying sketch shows a problem in pole construction which doubtless has confronted many engineers at some time. This pole was erected to act as a corner pole, the company fully expecting to place and

maintain guy wires across private property. After the pole was up conditions arose which would not permit the necessary guy wires, so that it then became necessary to devise means of holding the strain. The pole itself is 55 ft. in length, set 6 ft. in the ground, in an L alley, surrounded



Method of Strengthening Corner Pole.

by brick pavement up to the abutting property. Since the pole was of a size not equal to withstanding the strain, it was decided to brace it by screwing two 8-in. Matthews anchors into the ground, each about 12 in. away from the pole on the property line. Attached to each anchor is one set of double ⅜-in. strand, made fast at the top of the pole under the first gain. Strain insulators and turn-buckles were inserted in each strand, arranging a strut at about the center of the pole, and then tightening up on the turn-buckles.

This method was found to work out satisfactorily in every detail. It appears to the writer that the pole will withstand twice as much line pull when constructed in this manner as compared with the usual manner of attaching the guy at the top of the pole and at the surface of the ground. In the latter case the strength of the pole at the surface is all that can be depended on and it is necessary to concrete the pole. By the use of the anchor as shown, the pole is in compression and the guy wire in tension, the breaking point being transferred to about the center. It is believed that the pole will bend considerably before breaking, until finally the guy wire will take nearly all of the strain. This construction was easily installed, did not require any special concreting as in the old method and did not require the changing of poles or selection of a specially heavy pole. The cost of concreting was also saved.

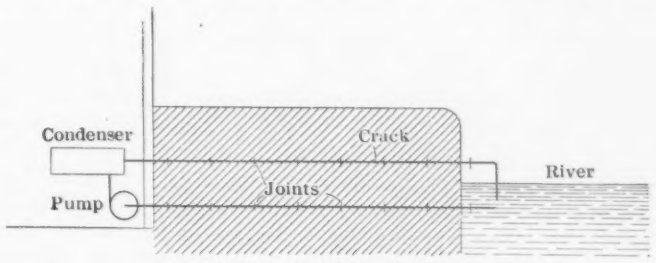
The entire rearrangement of guys, installation of anchors, etc., was accomplished in four hours' time with five men, whereas changing poles, transferring arms and wires and concreting would have required about sixteen hours for the same number of men. In the older construction of bracing the pole by guying it to its own base it is evident that the breaking strength of the pole at its base, the critical point, will be in no way affected or increased. But when guyed to ground anchors as described the tensile strain is transmitted to the steel guy while the pole remains in compression. Evidently the latter construction is not only twice but as many times as strong as the steel cables and anchors acting at 1-ft. radius arms are stronger than the outer wood laminæ of the pole. Under these latter conditions it is probable that when the pole ultimately fails this will occur by buckling when carrying a very high tensional load rather than by breaking off at the ground as the former construction is liable to do at much lower loads.

St. Louis, Mo. John L. Fay.

FRACTURED CONDENSER DISCHARGE PIPE IMPAIRED VACUUM.

About two years ago, while serving as engineer in charge of a small steam-turbine station, the vacuum on the condensers of the several 750-kw units was noticed to drop suddenly and none of our efforts availed to restore the exhaust pressure to the point where it was formerly maintained with ease. The circulating pumps were inspected and proved to be operating the same as before, but it was quite apparent that the quantity of water being moved was much less than formerly. After the pumps had been thoroughly gone over and found in good order it was suggested that perhaps a leak had developed at some joint in the upper discharge return line, impairing the syphon effect of the circulating system and thus requiring the pumps to elevate the water between the pipe levels as well as to move it against skin friction. Following this clew pits were dug at each joint of the 100-ft. run of 20-in. pipe between the station and the stream bank. So far as could be determined every joint where trouble would be likely to develop was as tight as on the day installed. The peculiar failure of the pumps was then attributed to some mysterious cause beyond the ability of mere station engineers to discover, and for a time the plant continued to run under impaired vacuum. Finally, in the course of some excavations made to change the discharge outlet from a point too near the intake, where the warmed discharge water would not be returned to the condensers, the real trouble with the vacuum was discovered.

On baring a length of the discharge line about 8 in. back from one of the joints an annular crack was found extending completely around the pipe and exposing an opening of ⅛ in. This crack, doubtless due to temperature-change contractions of the big pipe, had not been discovered when the joints were investigated before. Admitting air to



Sectional View of Installation.

the pipe, as it did, the syphon vacuum in the condenser circulation was destroyed and the pumps had been required to raise all of the cooling water 7 ft. or 8 ft. as well as to move it through the pipe line.

Minneapolis, Minn. H. L. Jensen.

QUESTIONS AND ANSWERS

In a number of alternating-current generator armatures that I have examined there were several cells per pole per phase in the winding. What advantage does this type of winding possess? H. B.

The winding described is known as distributed winding and results in better wave form. Moreover, the use of a large number of turns is necessary when the voltage is high. In order to minimize the number of slots several conductors are placed in one slot, thus giving jointly several turns per slot with a reasonable number of slots per pole.

In purchasing oil switches how may one determine what breaking capacity is necessary? G. P. W.

For generating stations it is usual to require the oil switch to have a breaking capacity of three times the normal rating of the apparatus installed without reference to the capacity of the feeders or apparatus controlled. It is questionable if a short-circuit current greater than this can be sustained. In substation practice the rule is to consider the maximum power that can be ruptured by an oil switch as equal to one-quarter of the square of the emf between wires divided by the resistance of one of the wires.

Is enameled wire suitable for use in making meter coils the extreme pressure between adjacent wires of which does not exceed 5 volts? G. H.

Enameled wire should prove excellent for meter coils. It is said to be absolutely non-hygroscopic and is not affected by temperatures that would prove destructive to either silk or cotton insulation. Moreover, the space-factor of enameling wire is much better than even that of a single-silk-covered wire, being, say, 65 per cent for the former as compared with 55 per cent for the latter. It is said that a thickness of enamel only 0.0008 in. thick can withstand 1500 volts.

In a reply given to H. L. O. in the Questions and Answers column last month it was stated that split-pole converters are not built except for 25-cycle circuits. I have seen a 60-cycle split-pole converter. S. C. E.

We have been informed by the General Electric Company that it has built split-pole converters for 40 and 60 cycles also. A 500-kw, 245/260-volt, 60-cycle machine is in operation in one of the stations of the Rochester (N. Y.) Railway & Light Company and two 1000-kw, 40-cycle, 240/280-volt machines are operating in the Schenectady Works of the General Electric Company. A number of smaller 60-cycle machines have also been built.

How many transmission circuits leave the Lockport station of the Sanitary District? What is the voltage and what the highest load carried? A. A. H.

From the Lockport (Ill.) hydroelectric generating station of the Sanitary District three transmission circuits extend to the terminal station in Chicago, a distance of 30 miles. The transmission tension is 44,000 volts, three-phase, and the maximum amount of power carried on each circuit is 8000 kw, or about 180 amp at 44,000 volts. The three wires of each circuit are of aluminum and each is equivalent to a No. 000 copper wire. Seven of the nine wires are supported on pin insulators and two on suspension insulators.

In a 440-volt, 60-cycle, two-phase system, two 220-volt lamps connected in series are used as test lamps. These lamps when connected across a certain wire on each phase give a brighter light than when connected directly to the two wires of either phase. What is the explanation? S. Van B.

In a 440-volt, two-phase system with interconnected phases the electromotive forces between the leads are as follows: Distinguish the leads of one phase as A and A^1, and the leads of the other phase as B and B^1. The electromotive force between A and A^1 is 440 volts; that between B and B^1 is 440 volts; that between A and B is about 310 volts; that between A and B^1 is 310 volts; that between A^1 and B^1 is 310 volts, and that between A^1 and B is 310 volts. If two similar lamps are connected in series across between A and A^1 or B and B^1, each will be subjected to 220 volts; but if an individual lamp is connected between one lead of phase A and one lead of phase B it will be subjected to 310 volts.

Given two three-phase lines of the same voltage and frequency, but operated from different generators, and suppose that an induction motor rotates in the same direction when operated on either of these lines. If the two generators have never been operated in parallel before, is it safe to close the switch between the two generators when one phase of one generator is in synchronism with one phase of the other generator connected to the other line? F. D. E.

Two polyphase generators can be considered to be in proper condition for placing in parallel if their electromotive forces are equal and one phase of one generator is in synchronism with the corresponding phase of the other generator, provided the rotation of phases on one generator is the same as the rotation of phases on the other generator. In the case mentioned by you the rotation of phases is undoubtedly correct when the two machines operating separately cause a certain induction motor to rotate in the same direction. The individual leads from the two generators, which should be connected directly together, should be identical with the three leads connected to the terminals of the induction motor. That is to say, if the leads on the induction motor are marked A, B and C, then the lead on generator No. 1, which is connected to lead A on the induction motor, should be connected to the lead on generator No. 2, which had been connected to lead A on the induction motor. The same statement applies to leads B and C.

Two exciters are employed in a hydroelectric station containing two 1000-kw units; one wound for 146 amp and 120 volts and the other wound for 125 amp and 120 volts. The speed of the first is 1500 r.p.m. and that of the second is 1400 r.p.m., both being belted to the same shaft. As one alternator is used at a time it is sometimes necessary to change the exciters on the circuit in order to inspect the exciter running. and as there is no equalizer connection between the exciters there is a question as to the proper method to use in this case without shutting down or causing three 150-hp motors 10 miles away to fall out of step. At first one attendant would stand at the busbar switch of one exciter and another attendant would throw in the busbar switch of the other exciter when the first opened his exciter circuit. This method, while it works properly, does not have the earmarks of good practice, and we would like to know how to run the exciters in parallel so as to effect the change without shutting down. B. E. C.

Two 120-volt, direct-current generators can be connected directly in parallel, provided the voltages are properly adjusted, without employing any equalizer connection in case the machines are not too highly over-compounded. You make no mention of the compounding of the machines, and as the machines are used as exciters, and probably for no other purpose, it is likely that they are not highly over-compounded. In any event, however, since they are both belted to the same shaft, they can be adjusted to equality in voltage, placed directly in parallel and any constant load properly divided between them by the use of field rheostats in the ordinary manner. If the machines are used exclusively as exciters, no reason exists for having them over-compounded. However, over-compounded machines could be used for this purpose. In case the machines used are over-compounded, a short-circuiting connection can be placed around the series field coils in each machine, thereby converting them into shunt machines, and they should operate properly for all loads, both when in parallel and when used separately.

Central Station
Management, Policies and Commercial Methods

ENERGY CONSUMPTION OF CONCRETE MIXERS.

Motor-driven concrete mixers deliver from 1½ cu. yd. to 2½ cu. yd. of mixed concrete per kw-hour consumed. The figure will be found to vary slightly with the length of motor-operated conveyor used, but as the mixer is the principal load and the hoisting demand is intermittent the average consumption recorded in mixing concrete for conduits, wall footings, tunnels, etc., has been found by a large user of motor-driven mixers to be about ½ kw-hour per cubic yard.

PURE WATER, PURE ELECTRIC LIGHT.

Illinois, like a number of other Western States, has a law forbidding the use of public drinking cups, and as a result collapsible paper cups make very acceptable souvenirs. For distribution among visitors to its booths in the various shows held in the Coliseum, Chicago, the Commonwealth Edison Company has had prepared a number of small paraffined folding cups, inclosed in envelopes which bear the legend: "Health demands purity in all things—pure foods, pure water, pure air and electric light, the only perfectly sanitary and healthful artificial illuminant—keeps the air pure. We wire houses at cost, two years to pay."

ELECTRIC PUMPING AT WEBB CITY, MO.

The water supply of Webb City and Carterville, Mo., will hereafter be supplied by motor-driven pumps. The joint water-works company serving the two nearby communities has just installed five Downie double-plunger deep-well pumps, each capable of delivering 500 gal. per minute from the 300-ft. depth and driven by 25-hp Westinghouse 25-cycle motors. The pumps discharge into a 5,000,000-gal. reservoir. Energy for the water-works is purchased from the system of the Empire District Electric Company at the rate of $1.25 per month for each hp connected, plus 1⅛ cents per kw-hour consumed.

ELECTRIC APPARATUS FOR RESTAURANT KITCHEN.

The New York Edison Company has closed a contract with the Childs Company for energy for its new restaurant building at 194-196 Broadway, New York City. Among the motor-driven equipment which will be operated from the mains of the central-station company are the following: A ½-hp potato-peeling machine, a ½-hp batter mixer, a 2-hp dumb-waiter, a 10-hp ice-machine, a 2-hp pump, a ½-hp pump for drinking water, five 2-hp dish-washing machines and two 10-hp ventilating fans. There will be twenty-six arc lights in the basement, twenty-eight arc lights on the first floor, twenty-three arc-lights on the second floor, and about 250 incandescent lamps. A sign lighted by 150 2-cp lamps will be placed upon the building front .

SPECIAL FEEDER TO DETERMINE DIVERSITY FACTORS.

In making a study of diversity factors and other ratios of central-station significance Mr. A. N. Richardson, general superintendent of the Kansas City Electric Company, has had an extra feeder, which is carried along one of the main streets of the city, reserved at present for residence-customer connections only. The average and maximum demands, consumption, etc., of this feeder will be recorded and average diversity factors in this way obtained. After a year's test of residential loads a number of business houses and commercial consumers will be connected to the same feeder and figures secured on these classes of business. The changes and varied demands to which an ordinary feeder is subject make it difficult if not impossible to obtain such customers' data without some special feeder provision.

PUMPING A POWER PLANT'S FUEL SUPPLY.

The plant of the Kansas City Electric Light Company, at Baltimore and Thirteenth Streets, is located in the midst of the steam-heating load which it serves, but is nearly a mile from the nearest railroad track. Formerly seven three-horse teams were required to haul the fuel for this plant, which contains 3600 hp in boilers.

A 4-in. oil pipe-line has now been laid directly to the station from the Missouri River power plant of the company, 7000 ft. distant, and the crude petroleum burned under the boilers is pumped this distance against a pressure of 90 lb. by Worthington duplex steam-driven pumps in the river station. A 6-in. feed-water pipe parallels the oil line and will be used for supplying purified water to the steam-heating boilers when the water-treatment plant is completed in the riverside station. With its steam units exhausting non-condensing into the heating lines the plant will thus be unique in its freedom from auxiliary apparatus.

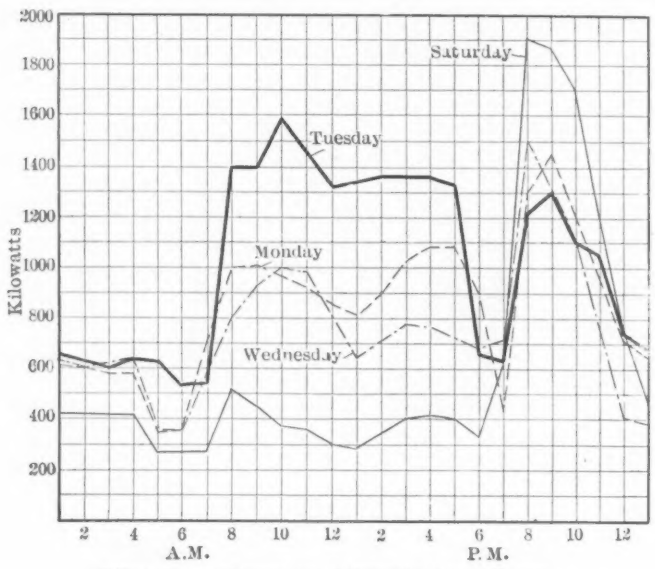
MOTOR DRIVE OF THE LONGEST DRAWBRIDGE.

The longest drawbridge ever built is worked by central-station energy and operated at a cost quite small compared with what it would have been had an isolated plant been provided. This bridge carries the tracks of the Illinois Central Railroad across the Missouri River at Omaha, Neb., and has an open draw of 520 ft. It is operated by a 50-hp motor, which can swing the heavy steel structure through an arc of 90 deg. in 90 seconds. As a precaution against accident to the line wires interrupting service, the bridge is supplied with energy over lines from the plants of both the Omaha Light & Power Company and the Council Bluffs (Ia.) Citizens' Gas & Electric Company, on opposite sides of the river. A double-throw switch is provided, so that in case of failure of one circuit the other can be substituted. Each electric company makes a minimum charge of $5 a month for readiness to operate the bridge, and as the draw is not often used the total consumption of energy never exceeds the minimum charges, totaling only $10 a month. To maintain a special plant to operate such a bridge would, of course, cost more than $100 a month.

ELECTRIC HEATING LOAD AT ALTOONA, PA.

At the recent convention of the Pennsylvania Electric Association Mr. E. B. Greene, superintendent of operation of the Penn Central Light & Power Company of Altoona, Pa., exhibited some curves showing the effect of the heating load on the station operation on Tuesday. Altoona is a

typical railroad town with a population of over 50,000, and there are in use at the present time over 4200 flatirons. Most of the washing and ironing is done in the homes of the people at Altoona, and the ironing load on Tuesday makes itself felt in the steam stations, oftentimes necessitating an extra unit during the day and an extra fireman in the boiler room. Load curves for Monday, Tuesday, Wednesday and Saturday, July 31, Aug. 1, 2 and 5, respectively, are shown herewith, from which it will be evident that the peak load on Tuesday, due to the use of flatirons, comes at 10 o'clock in the morning, exceeding the evening peak by 300 kw. It will also be seen that the ironing load affects Monday's and Wednesday's curves in addition, the morning peak being highest on the first three days of the week, being 1000 kw on Monday and Wednesday, 600 kw on Thursday at 11 o'clock, 400 kw on Friday at the same hour and 500 kw on Saturday at 8 o'clock. Tuesday morning's peak exceeds Monday morning's peak by 600 kw and, as shown in the diagram, the load begins to pile up at 7 o'clock in the morning and does not begin to drop again until after 5 o'clock in the afternoon. The lighting load does not come



Effect of Flatirons on Altoona's Load Curve.

on until after 7 o'clock in the evening, owing to the length of day at that time of the year. The curves indicate what can be done with the electric flatiron in the average city. In Altoona the desire to use the flatiron has been the means of causing many householders to install electricity.

ELECTRICALLY COOKED HOT CAKES IN A DES MOINES RESTAURANT.

The manager of the Boston lunchroom, Des Moines, Ia., desired an attractive electric hot plate for cooking griddle cakes in his front window. As Mr. J. L. Bradfield, contract agent for the Des Moines Electric Company, could find no suitable device on the market he drew up plans for an original hot plate of aluminum, using three 400-watt disk-heating elements. The aluminum top, designed for three cakes, as made, measures 8 in. x 20 in., the disk elements being set into the underside of this casting.

To secure an efficient temperature control of the plates the three 400-watt elements are arranged to be connected in parallel across 110 volts for the high heat and all three in series across 220 volts for the low heat. The accompanying sketch shows the ingenious application of a double-throw, three-pole switch for obtaining these connections. On the low-heat position only one of the contact clips is in use, the others being left in place for the mechanical stability of the switch, which is mounted on the hot plate.

On the first day that the electric griddle was installed 3000 cakes were baked on it, each order of three cakes averaging ninety seconds. During the rush hours the 1200-watt high heat is used, but at other times of the day when orders are intermittent the low-heat series position, taking 533 watts, keeps the plate hot enough for service.

The aluminum surface requires no greasing, and as the

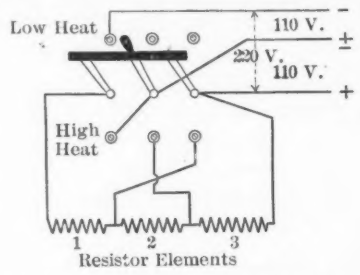


Diagram of Connections for Electric Hot Plate.

metal is a good heat conductor the cakes are cooked uniformly to an appetizing golden brown. The two hot plates now in use cost about $20 apiece as built specially. The lunchroom proprietor is delighted with the performance of the hot plates as well as the advertising they afford his place.

THE ELECTRIC VEHICLE IN LOUISVILLE.

The Louisville Lighting Company, through its business-promotion department, which is in charge of A. T. Macdonald, has succeeded in increasing not only interest in electric vehicles, but has added largely to the number in use in that city. *Chained Lightning,* issued by the company, has been one of the most successful means of co-operation. A department is given up to this feature each month, pictures and stories having reference to the use of both passenger and freight-carrying cars being reproduced. Local examples are given wherever possible of the satisfaction gained through the use of this type of car. In the near future a special electric car edition will be issued by Mr. Macdonald, who edits the paper.

A selected list, consisting of about 2000 names, who are now consumers of electric current, is used in connection with a postcard campaign having to do with electric vehicles, the same idea being applied in other directions. Prospective purchasers of cars are told about the electric vehicle in this manner and the use of rectifiers and other more or less technical features explained in a simple way.

HORSES--versus--ELECTRICS
SHOOT 25 HORSES AFTER FALLS ON ICY PAVEMENTS
S. P. C. A. Orders Its Agents to Arrest Anyone Found Abusing Overloaded Animals.
All the available inspectors of the Society for the Prevention of Cruelty to Animals have been ordered out today to
To a smaller degree these conditions existed in Louisville. The sane solution is:
Use---
Electric Cars
HOT WAVE CAUSES MILLION DOLLAR LOSS IN HORSES
Twelve Hundred Equines Die From Heat in New York City.
LAST WINTER
ASK US?
TWO WEEKS AGO
311 W. Chestnut
LOUISVILLE LIGHTING COMPANY
INCORPORATED
Louisville, Ky.

Electric-Vehicle Advertisement.

Largely as the result of this exploitation, supplemented by the references to the principal points in favor of electric cars, which are made in the regular newspaper advertising of the company, many installations of charging apparatus have been made.

The newspaper advertising which is being done consists

of advertisements for electricity in connection with light, heat and motor service, but a consistent part of the campaign has been in favor of electric vehicles. The fact that the exploitation has been successful is shown by the increase in the number of cars. When the work was started two years ago there were only nineteen cars of this sort in Louisville. Now there are over 100, with prospects for the number being increased to 200 within the next few months.

In order to secure for owners of electric vehicles the proper service, the Louisville Lighting Company secured the establishment of a maintenance garage by George Keeler, a Louisville battery expert, quarters being fitted up immediately in the rear of the company's offices. Mr. Keeler has organized the Keeler Company, securing the agency for a pleasure vehicle and an electric truck, the latter being the first commercial car of this kind introduced in Louisville.

The traffic department of the lighting company is cooperating with electric vehicle manufacturing companies which have been organized in Louisville. The Electric Vehicle Company has just begun to turn out trucks operated by electric power, while the Continental Car & Equipment Company has completed equipment of a section of its plant for this purpose. The Louisville Lighting Company has given descriptions of these enterprises in *Chained Lightning* and will co-operate with them in other ways.

The advertisement reproduced herewith is from *Chained Lightning*, showing the advantages of the electric car over the horse. The ad is the work of Mr. Macdonald.

JOPLIN HAS AN ELECTRIC SIGN FOR EVERY BUSINESS.

Two years ago the little city of Joplin, Mo., had not a single electric sign. Now there are 200 in use, averaging sixty lamps each.

Curiously enough, the first sign installed was for an undertaker. Feeling the competition, it was not long until the other leading director of funerals had ordered one, too. These two undertakers' electric signs, only a short distance apart, are shown in Fig. 1.

Electric signs on livery stables throughout the country are about as plentiful as the eggs of the fabled roc, but Joplin has a couple of such displays, one with a prancing steed atop it being reproduced in Fig. 2. In addition there are several spectacular displays, and a couple of buildings, including the electric company's office, are outlined with

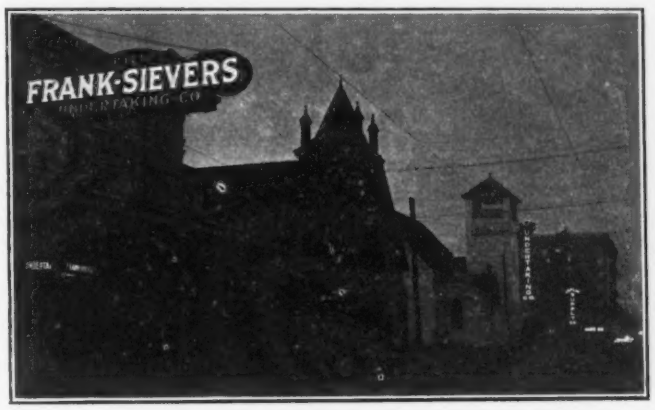


Fig. 1—Two Undertakers' Electric Signs at Joplin, Mo.

tungsten lamps. Joplin is in the midst of the zinc-mining district and one of the unusual commodities advertised by electric light is dynamite, an announcement which sometimes startles the gentle visitor.

The electric company's window, lighted to the unusual intensity of 27 ft.-candles, is made the means of many attractive displays, which are changed frequently enough to attract attention.

Signs are operated on a flat-rate basis, at a cost of 15 cents per 4-cp, 5-watt lamp per month, including patrol service. The electric company sells standard business signs on an instalment plan, when desired, allowing the purchaser to pay 15 per cent of the price in cash and the remainder in twenty-four monthly payments.

Fig. 2—One of Joplin's Unusual Electric Signs.

Mr. T. C. Bradshaw is illuminating engineer for the Empire District Electric Company, which furnishes the lighting for Joplin and neighboring towns of the Empire lead and zinc-mining district.

COMBINATION ICE-ELECTRIC PLANT OPERATION.

A talk of much practical value and interest on the subject of combination ice-electric plant operation was given by Mr. W. E. Sweezey, of Junction City, Kan., before the Kansas electrical convention at Independence, Sept. 21.

Mr. Sweezey has had nine years' experience in combination-plant operation and at present has a 35-ton plant in connection with his central station. The same boilers do the work of both plants, the demand of each varying almost exactly inversely as the other. The figures of coal consumption submitted by Mr. Sweezey show how the sum of the two demands is nearly constant, one increasing almost exactly as the other falls off. The following table shows the tons of coal burned and the electricity and ice produced during six typical months of winter and summer:

	June.	July.	August.	November.	December.	January.
Tons coal burned	670	675	700	580	620	600
Kw-hours generated	108,780	111,710	122,500	146,430	162,121	155,160
Tons ice made	965	1,055	1,050	112	54	32

To make a single ton of ice, observes Mr. Sweezey, costs about as much as to make 10 tons. In the Junction City plant the same engineers and firemen are employed the year around, as the coal burned and energy converted are practically uniform throughout the twelve months. The only extra labor required by the ice plant is for "pulling" the cakes from the cans, which for the 35-ton outfit costs about $5 a day. This amounts to an extra labor cost of about 25 cents per ton of ice, but, of course, in the plant accounting the general station charges as well are divided up

equitably between the ice and electric departments. As the result the unit cost of producing a kw-hour in summer, when the output is decreased by 33 per cent, is almost exactly the same as during the heavy loads of the winter months.

Mr. Sweezey remarked that a town unable to support twenty-four-hour service should not consider the installation of a combination ice plant. He admitted, however, that the establishment of the ice end, making all-day service possible, might soon justify itself through the day load of fans and motors obtained, probably later making it worth while to run on through the winter with the day load acquired.

When a plant is operating efficiently on a condensing basis motor-driven compressor pumps may be desirable. If the station has a good load-factor and the generator engine is exhausting into the atmosphere, however, a steam-driven compressor may be preferred, since all the steam it passes, with perhaps more, will be needed as distilled water for ice-making.

At Junction City it is now planned to install a steam turbine with a surface condenser, the water recovered from which will be free from oil and excellent for ice-making. Motor-driven compressors will be used. No trouble is expected in shutting down the refrigerating machinery during the peak lighting load. If the tank be carried along at about 12 deg. above zero, Fahr., the compressor can be shut off twelve hours without danger, for the tank temperature will remain below freezing at least as long as this if properly insulated. The danger lies in the tank temperature reaching a higher value and melting the ice of the cakes against the car surface. When this water later re-freezes it will expand, straining or bursting the cans.

Ice storage is of real advantage to a plant, often enabling it to run fully loaded during the partial-demand periods of fall and spring and to shut down altogether during the winter, when only a few tons per day are used. For packing ice for shipment straw trampled down around the cakes is used, the top layers being covered with a bed of straw 1 ft. thick. Paper has also been used for this purpose.

The present Junction City plant is operated at an output of 5 tons of ice per ton of coal, or about 1½ hp-hours per pound of ice. With his turbine equipment Mr. Sweezey expects to decrease this to ½ hp-hour per pound of ice.

CENTRAL-STATION EXPANSION AT MONTROSE, COL.

Coincident with the development of the ranch country in west central Colorado the Montrose Electric Light & Power Company has enjoyed a substantial increase in business. The total number of customers on the company's lines has increased from 492 to 685 within the past two years and at present about 20 per cent of the population is included in the list of the company's patrons, this being one of the largest proportions of consumers to population in the West. Of 772 residences now in the town only 112 remain unwired for lighting service.

The company generates its own electrical energy at a steam plant near the business center of the town, the installation consisting of three horizontal return tubular boilers operated at 120 lb. and three engine-driven alternators delivering energy at 2300 volts. The generating units consist of a 50-kw set directly driven by an Ideal engine, a 150-kw machine directly driven by a Chuse engine and a 150-kw generator belted to a Ball engine. The first two engine units named are of the tandem compound type and the other equipment is a simple engine operated only in emergency service. All engines in the plant are run non-condensing and the average fuel consumption of the plant in 1910, burning slack coal of about 11,000 heat units per pound, was 8.8 lb. per kw-hour. The plant furnishes twenty-four-hour service.

EMERGENCY CENTRAL-STATION PUMPING SERVICE.

A recent addition to the company's connected load is a municipal pumping plant designed to increase the pressure

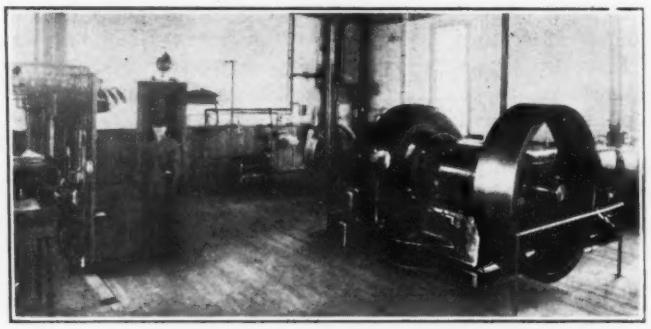


Fig. 1—Interior of Generating Plant.

on the local water system in case of fire. The company holds itself in readiness to supply energy at any instant of the day or night to this station, which is located about 1500 ft. from the plant and which contains a two-stage centrifugal pump having a capacity of 750 gal. per minute, directly driven by a 100-hp, 2200-volt, three-phase, 60-cycle induction motor equipped with an auto-transformer starter. A circuit of No. 6 copper connects the pumping station with the power house. The supply of water for the town is obtained from the Cimarron River, the normal pressure at hydrants being 70 lb. There are forty-two double hydrants, 16 miles of 8-in. and 10-in. mains and 2.5 miles of from 4-in. to 8-in. distributing pipe in service.

The new pumping plant displaces a steam-driven installation and is designed to raise the water pressure to 125 lb. in case of a fire demanding an ample supply of water at high pressure. The pump takes water from the Uncompahgre River, which flows through the town beside the station and forces the water through a check valve into the regular urban system. A relief valve set at 125 lb. is installed at the station and a check valve is located in the incoming main from Cimarron about 1.5 miles from the business center to prevent the motor-driven pump from forcing water backward into the reservoirs.

In case of an alarm of fire the operator at the company's station ascertains whether the high-pressure service is

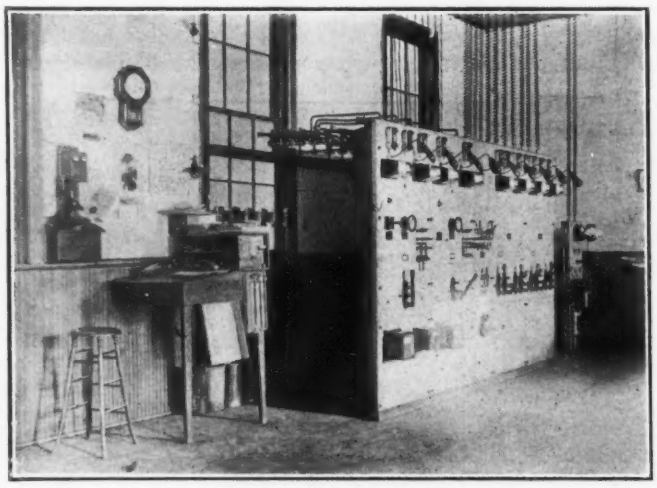


Fig. 2—Switchboard.

needed, and if so starts the motor by an oil switch located on the main station switchboard, it being unnecessary for anyone to go to the pumping installation proper. The motor can be brought up to full speed under load in thirteen seconds, and in a recent trial the water pressure was raised

to 120 lb. in sixteen minutes. The system has been found especially useful in dealing with fires occurring in the daylight hours when the pressure tends to run low on account of the irrigation of lawns and gardens. The pumping plant is owned by the town and payment for the service is based upon a minimum charge plus a kw-hour rate for excess energy consumed. The protection furnished by the installation, which has been in service only a few months, has resulted in more favorable insurance rates within the town. The motor and starting equipment have proved thoroughly reliable in service.

The company has a total connected load of 646 kw, including 288 kw in lighting service, 193 kw in motors, thirty-four electric fans and over 300 flatirons, besides 55 kw in miscellaneous heating and cooking devices. The rates for lighting run from 14.4 cents to 9 cents net, depending upon consumption, and motor-service rates run from 10 cents to 3 cents per kw-hour. A minimum charge of $1.35 per month is made in lighting installations. The motor service includes, besides the pumping station, a brick and tile yard using an 85-hp motor, planing mills, foundry, machine shop and three newspapers. All the butcher shops in town are also provided with motor service and the principal laundry is a customer.

The street lighting is supplied by twenty-eight alternating-current 6.6-amp series arc lamps operated on an all-

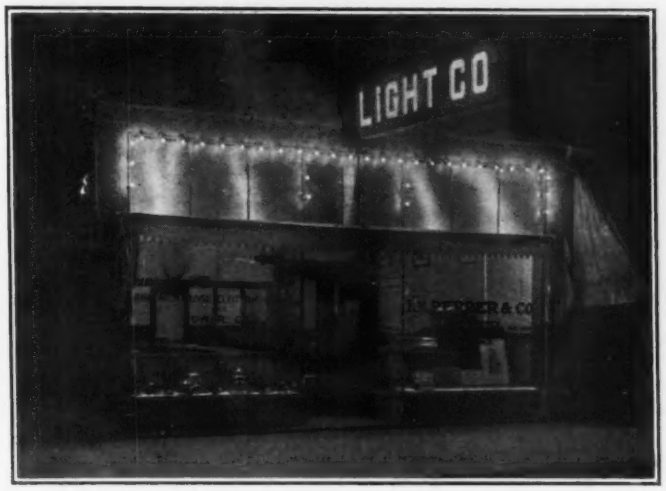


Fig. 3—Exterior View of Office.

night and every-night schedule. A recent extension of the company's connected sign-lighting load is illustrated in the accompanying view of the company's own office, which was illuminated in outline by twenty-seven 5-watt tungsten lamps, a sign containing sixty lamps of the foregoing size and an interior installation of twelve 100-watt tungsten lamps. The office has a frontage of 23 ft. and a depth of 56 ft. The company makes a flat rate for sign lighting which nets about 6 cents per kw-hour.

RANCH LIGHTING CIRCUITS

A special lighting circuit about 5.75 miles long has just been put in service at the expense of the company between the generating plant and a group of large fruit ranches lying at the west of the city. Continuous service is given on this circuit to thirty-eight customers, fourteen transformers being installed. The usual rating of transformers on the line is 3 kw, the maximum unit being 5 kw. The line consists of a single-phase circuit of No. 6 copper carried on glass insulators and wooden cross-arms and poles, the latter being of Idaho cedar, 30 ft. in length with 6-in. tops and set in concrete foundations to a depth of 18 in. below ground. The pole bottoms are carried to a depth of 5.5 ft. Seven pole-type lightning arresters are installed on the line and the cost of its installation, including construction, meters and transformers, was $800 per mile. Mr. C. L. Flower is manager of the company.

A MOTOR-OF-ALL-WORK ON A MISSOURI FARM.

Mr. C. D. Bellows has a 640-acre farm 4½ miles from Maryville, Mo., and not only lights his house, barns and grounds by electricity delivered over his own transmission line from the Maryville central station, but performs his

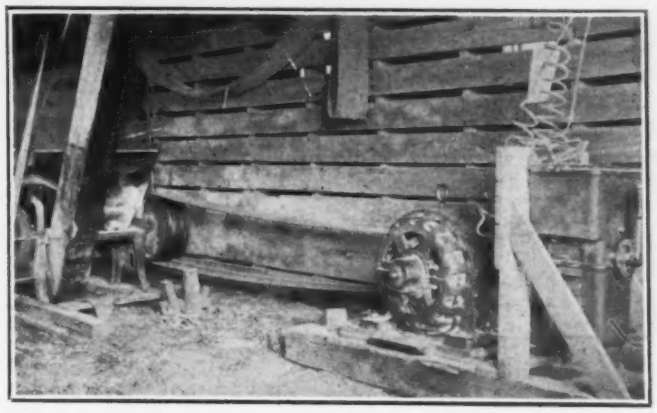


Fig. 1—Farm Motor on Skids Driving Feed Cutter.

farm work with a 20-hp induction motor, mounted on skids, which can be moved about his place and attached at any of the numerous connections in his barns and silos.

The three-phase, 60-cycle, 2300-volt transmission line was built by the local electric-light company, of which Mr. C. C. Hellmers is manager, at the expense of Mr. Bellows, and is of best construction, with painted poles, creosoted butts, etc., costing the owner about $425. In the case of another line serving a farm installation 4 miles northeast of Maryville the farmer attempted to economize in building his own line and this work has given much trouble.

Mr. Bellows' meter is mounted in a pole box at his farm and he pays the same rate as the regular Maryville town customers.

The lines on the farm premises are tapped at nine points for motor connections. At each of the three barns and four silos the taps are brought to knife switches, from which hang the wires for attaching under the binding posts of the motor unit terminals. The motor which is used for general work about the Bellows farm is a 20-hp machine of the three-phase, squirrel-cage induction type mounted on 8-in. x 8-in. skids, with its starting compensator. The motor unit can be rolled up to any machine to be driven, the wires being slipped into the terminal blocks and the switch closed. The cut-out switches are, of course, ordinarily left open

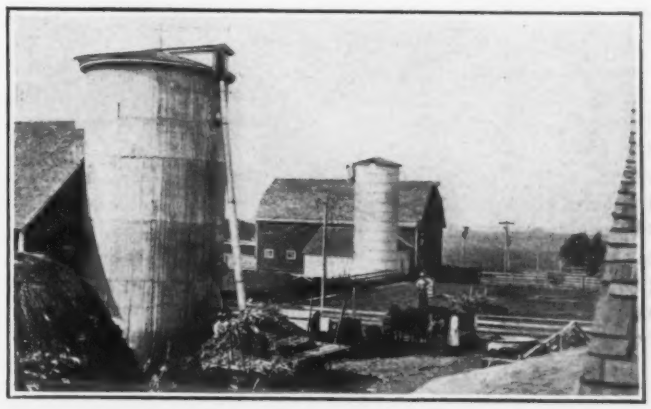


Fig. 2—Cutting and Elevating Ensilage with 20-hp Squirrel-Cage Motor.

when not in use, to prevent contact between the jumper wires. In Fig. 1 the motor is shown driving a feed cutter in one of the barns. In Fig. 2 the same motor is seen driving an ensilage cutter, and also operating the blower which elevates the ensilage into the concrete silo.

This motor has been handled in the characteristic rough manner given farm machinery and is frequently left out in the rain and wet weather without perceptible damage. It has now been in service nearly two years. Mr. Bellows also pumps his water supply by electricity, having a special 5-hp motor for this purpose.

During the last season forty-five acres of corn on this farm were cut up into ensilage, the work being done by the 20-hp motor in a day and a half, or less than half the time formerly required with a gasoline engine. The Bellows installation is a thoroughly practical one, which has been given two years of the hardest service, and the owner declares that he would on no account return to the gasoline engine he formerly used.

Wiring and Illumination

COTTON-MILL ILLUMINATION.

At the semi-annual meeting of the National Association of Cotton Manufacturers, held in Manchester, Vt., Sept. 27-30, a paper entitled "Practical Considerations in Cotton-Mill Illumination" was presented by Mr. J. M. Smith. The author claimed that the proper criterion for cotton-mill illumination is duplication by artificial light of the work obtained by daylight. Daylight conditions should be simulated at night to such an extent that the entire room will be brightly enough lighted to have a cheerful appearance and give the idea of wide-awakeness. The light should be acceptable to the operators. It should be free from qualities injurious to the eyes, and, what is nearly equivalent, it should cause as little fatigue as possible. With the progress and improvement that is being made in the humanitarian features of factories the mill owners will soon be required to give proper attention to these matters. If bad lighting conditions are allowed to continue without efforts being made to alter them, legislation will be enacted to control the matter.

Two general classes of illumination should be employed in mill lighting, namely, general and local. There should be, first, a uniform illumination of sufficiently high intensity to permit work in any part of the room. This result is ordinarily accomplished by distributing units placed approximately in squares over the entire area to be lighted. Local illumination is obtained by the use of a single lamp with a reflector to light a relatively small area. Where tungsten-filament lamps are used the 40-watt and 60-watt sizes, equipped with intensive reflectors, have proved very popular. There is a considerable range for choice as to reflectors. Proper light distribution can be obtained from either the steel or the glass type. The reflector used should be of such design as to cover the lamp sufficiently to protect the eyes of the workers from the direct glare of the filament. The steel reflector is somewhat lower in first cost than the glass reflector, while the depreciation due to dust is about equal for the two types. On the other hand, it is possible to determine easily when a glass reflector has been properly cleaned, whereas the efficiency of the metal-type reflector may be considerably impaired without this fact being easily detected by inspection.

WIRING OLD RESIDENCES.

The usual householder is in fearful expectancy of the damage which will be done during the wiring of his home, and for this reason postpones or gives up altogether having the work done. To show the timid that these fears are groundless and that houses are wired with a minimum of damage and dirt, Mr. C. F. Farley, contract agent for the Kansas City Electric Light Company, has had photographs taken of actual wiring jobs during the progress of the work. These pictures are substantially bound and mounted for the use of the solicitors in the housewiring campaign now under way in Kansas City. The photographs show various types of wall, ceiling, fixture and switch outlets, proving the small damage and dirt produced during a modern wiring job.

Enlargements of these pictures, mounted on electrically lighted easels and arranged with receptacles for housewiring literature, are also placed in drug stores in the residential sections, and the druggists are offered rewards of $5 each for all house-wiring contracts secured through them. A similar offer of $5 per house wired has been made to all employees of the electric company, other than solicitors, who bring in contracts.

OUTLETS.

Number of Outlets.	Old House Wiring, Class "A," Single Flooring Taken Up and Relaid.	Old House Wiring, Class "B," No Flooring Taken Up or Relaid	New-House Wiring, Class "C."
5	$19.81	$14.86	$ 9.91
6	22.31	16.73	11.16
7	24.81	18.61	12.41
8	27.31	20.49	13.62
9	29.81	22.36	14.91
10	32.31	24.24	16.16
11	34.06	25.55	17.03
12	35.81	26.86	17.91
13	37.56	28.17	18.78
14	39.31	29.48	19.66
15	41.06	30.80	20.53
16	42.81	32.08	21.41
17	44.56	33.42	22.28
18	46.31	34.73	23.16
19	48.06	36.05	24.03
20	49.81	37.36	24.91
21	51.56	38.67	25.78
22	53.31	38.98	26.76
23	55.06	41.32	27.53
24	56.81	42.61	28.41
25	58.56	43.92	29.28
26	60.31	45.24	30.16
27	62.06	46.55	31.03
28	63.81	47.86	31.91
29	65.56	49.17	32.78
30	67.31	50.49	33.66
31	69.06	51.80	34.53
32	70.81	53.11	35.41
33	72.56	54.42	36.28
34	74.31	55.70	37.16
35	76.06	57.05	38.03
36	77.81	58.36	38.91
37	79.56	59.67	39.78
38	81.29	60.97	40.64
39	83.24	62.43	41.62
40	85.31	63.98	42.65
41	87.46	65.60	43.73
42	89.51	67.17	44.75
43	91.56	68.67	45.78
44	93.61	70.21	46.80
45	95.66	71.75	47.83
46	98.71	74.03	49.36
47	99.76	74.82	49.88
48	101.81	76.36	50.91
49	103.86	77.92	51.93
50	105.91	78.43	52.96
51	107.96	80.97	53.93
52	110.01	82.24	55.01
53	112.06	84.05	56.03
54	114.11	86.11	57.06
55	116.16	87.05	58.08
56	118.21	88.66	59.11
57	120.26	90.20	60.13
58	122.31	91.80	61.16
59	124.36	93.27	62.18
60	126.41	94.81	63.21

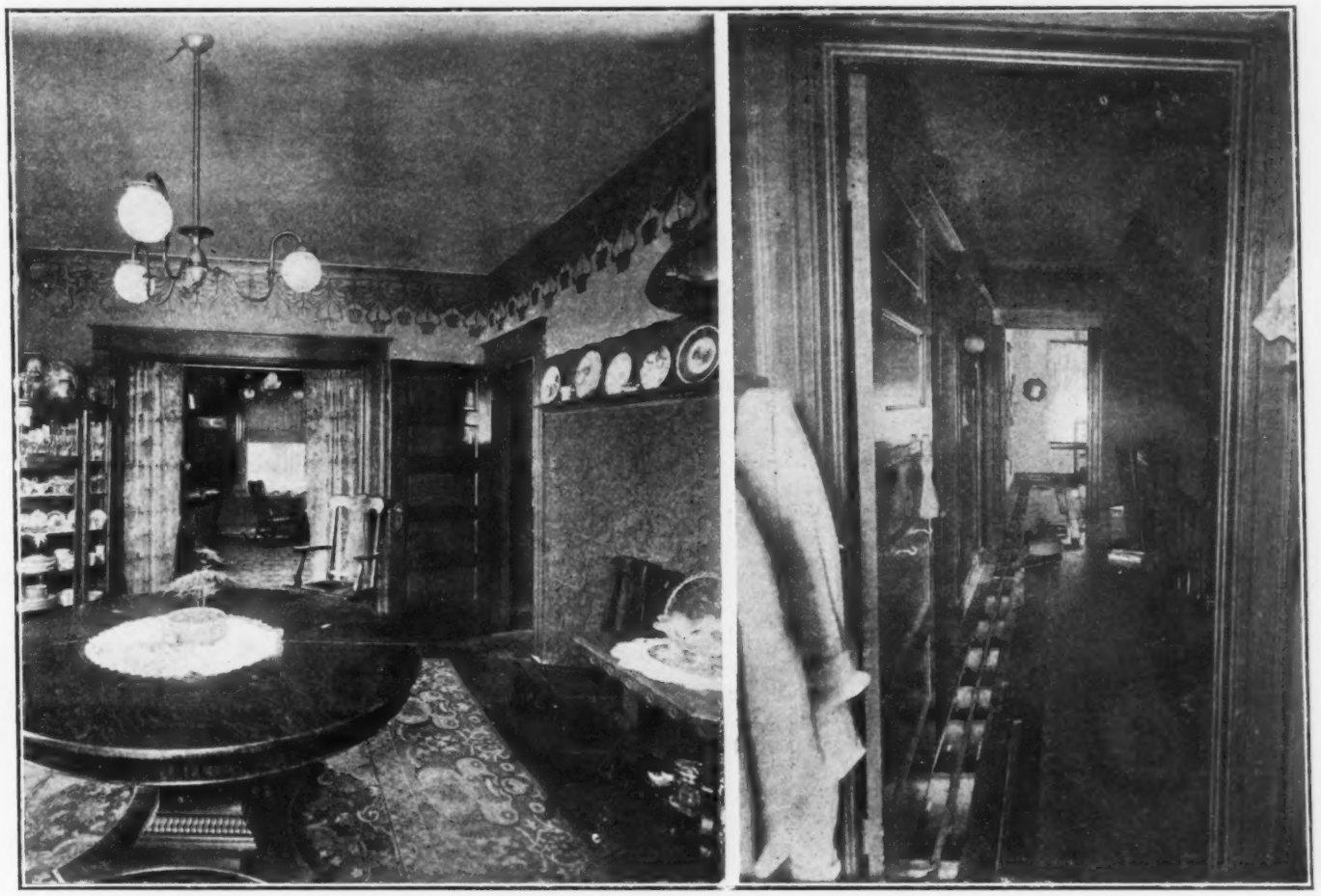
The present house-wiring campaign in Kansas City is conducted on a cost basis, the company giving the customer a year in which to pay. New customers secured by the company's solicitors are given a card with the names of the twenty-four contractors who compose the local association having an agreement to perform work at a fixed price per outlet. The customer may choose any one of these he de-

sires, and the contractor, on completion of the work, is paid by the company in full at the price agreed upon. This amount is later collected from the consumer in twelve monthly instalments. The schedule quoted relates only to time-payment contracts. If a customer wishes to pay cash he is advised to call for bids. The company takes no part in these cash transactions, but as a result of its campaign the total number of old houses wired by contractors in this time is more than twice the twelve-payment contracts secured.

The schedule of costs agreed to by the contractors has been figured by them as allowing the minimum of fair profit. Recently this schedule was decreased 25 per cent. The average cost of wiring in the Kansas City campaign has proved to be about $45 per house. The company's twelve-month payment offer relates to wiring only and is not extended to covering the cost of fixtures.

On the preceding page are shown the wiring prices charged by the Kansas City contractors for various classes of structures, which have been figured on local conditions and costs.

The Kansas City campaign is supplemented by an attractively printed booklet, "Your House Wired for Electric Light." This explains in simple, clear language the domestic applications of electricity and the ease with which wiring can be done.

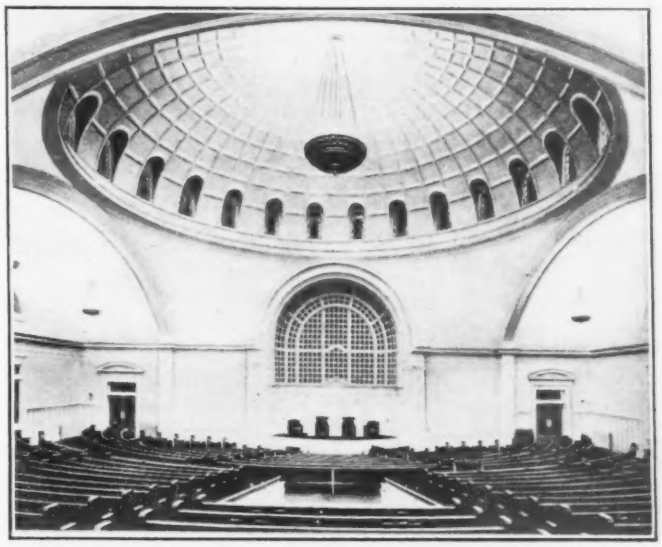


Solicitors' Photographs Showing How House-Wiring is Done with Slight Annoyance.

INDIRECT LIGHTING OF A DOMED AUDITORIUM.

One of the first applications, if not the only one, of indirect lighting to a large domed interior has just been made in the illumination of the auditorium of the Eighth Church of Christ, Scientist, at the corner of Forty-fourth Street and Michigan Boulevard, Chicago. The large room measures 92 ft. x 100 ft. over all and its central feature is a circular dome, 60 ft. in diameter and 50 ft. in height, measured from the floor to its apex.

Suspended by massive chains from the center of this dome is the principal indirect-lighting unit, a huge white bowl 7 ft. 6 in. in diameter and probably the largest indirect fixture ever built. The bowl, which hangs 12 ft. below the top of the dome, contains twenty 250-watt tungsten lamps, each in an individual inverted silvered reflector. These lamps are controlled under twenty separate circuits so that any intensity of illumination required in the auditorium can be obtained from the switchboard just behind the rostrum.



Indirect Illumination of a Large Domed Interior.

At either side of the main dome are arches, treated in the same cream-color tint as the rest of the church interior. Each of these side arches is lighted by three indirect-fixture bowls, each bowl containing five 100-watt tungstens. The rear of the auditorium is similarly lighted by six bowls, each containing six 100-watt units.

A Chicago city ordinance requires that in public halls a fixed proportion of the lighting for every 100 sq. ft. of floor surface must be controllable from one of the principal entrances to the room. These emergency lamps are grouped among the other lamps in the indirect fixtures so that a fair degree of illumination can be obtained from the switch in the public entry if the hall is to be entered when otherwise dark. The general illumination is, as already mentioned, controlled from the panel box behind the rostrum.

For cleaning and renewing lamps the large central indirect fixture is hung by a worm gear and can be lowered to the floor. Its lamps are supplied through flexible cables which are normally laid up loosely over the dome ceiling. The smaller indirect fixtures are reached by means of a ladder.

Letter to the Editor.

Evaluating Depreciation.

To the Editor of Electrical World:

Sir:—It is evident from recent articles and discussions that the engineering profession is taking a decided interest in problems of depreciation. The recent articles in the *Electrical World* and elsewhere serve to bring out very forcibly the confusion of terms to which Mr. Henry Floy called attention in his A. I. E. E. paper. The need for a more general agreement on terminology, for which Mr. Floy made a plea, is shown more and more clearly with each new publication.

The greatest confusion seems to come in trying to state what constitutes the "value" of property subject to depreciation. This value at any time is generally conceded to be the new value, less depreciation. But as the "value" may be arrived at on different theories, and as value depends on a large number of factors, many engineers in their anxiety to give fair weight to efficiency of operation seem to have confused "operating efficiency" with "value," and in some cases use these terms interchangeably. Then with "value" stated in terms of "operating efficiency" they subtract such "value" from new value based on cost, and thus working backward get a misleading figure that they call "depreciation." Since real depreciation, arrived at by saner methods, is a very different quantity, it follows that several brands of depreciation, "absolute," "theoretical," etc., are on the market, a variety to suit every taste and purpose.

Without attempting to give a political economist's definition of "value," but considering the term only as applied to an electrical property, the writer would describe value as something depending upon the quantity and selling price of *useful service remaining* in the particular bit of apparatus being appraised, and to the then owners—plus salvage value of course. Obviously the description does not make appraisal any easier, but it may, if acceptable, give a definite goal to work toward.

For the purposes of appraisal a given machine should only be allowed the estimated value of service, to present owners, remaining in a machine. When the machine has really reached scrap value it should be allowed no value whatever as a part of a plant. The scrapped machine should be regarded as so much cash in the bank and should at once be converted into cash by selling it for its scrap value. It should be borne in mind, however, that if there is any economically efficient service left in the machine, either as a reserve, or as insurance, or for any other purpose, it follows that scrap value has not been reached for that machine.

Value of a particular machine, to a particular owner, at any given time, is a perfectly fixed thing, no less fixed because difficult, or impossible, to determine. Engineers, in making appraisals, should so regard value and should think of their work as an effort to determine as exactly as possible an obscure but exact quantity.

New value has generally been considered as original cost—various overhead charges, such as engineering, interest during construction, insurance, bond discount, contractors' profit, promotion, expenses, etc., being added. To the writer's mind all of these overhead charges are, in fact, a *part* of original cost, since it is usually impossible to produce a plant without such expenses. Perhaps, if in appraising properties engineers should stop calling the bare individual price of machinery, buildings, etc., "total cost," afterward adding on the overhead charges—but should instead in each appraisal enter each reasonable overhead charge as a "cost" (cost of engineering, cost of legal services, cost of promotion, etc.)—the total would seem more reasonable to an uninformed public. It seems to the writer that many a warm controversy could have been saved simply by such a change in the usual method of tabulating an appraisal.

However, disregarding the difficulties of appraising both new value and value after use, it is certain that the difference between new value and any later value is depreciation. If now we admit that value is value, and is the *same quantity,* whether called value for capitalization, value for rate-making, value for paying taxes, value for determining annual depreciation or for any other purpose, we shall have to say that depreciation is an equally definite thing. The definite character of a quantity must not be confused with the difficulty of measuring that quantity. The wave-length of sodium light was just as fixed a thing a thousand years ago as now, though probably there was no one on earth a thousand years ago who could measure it. So the uncertainty in estimating the value of a public utility is wholly due to the difficulty of appraisal and not to anything else. If all this be conceded, one engineer may estimate the depreciation of a property at one figure and another man may put the same thing at another figure, but neither engineer may properly say, "If the figure is for tax purposes it is one thing, and if to figure rates on it is quite another."

If a machine depreciates $5 per year for ten years its depreciation in ten years is $50. Operating expenses should have been charged $5 each year on account of that machine. These propositions are so self-evident that it is astonishing to find so large a section of the engineering public contradicting them.

Of course if a public utility has failed to collect the proper depreciation fund each year or has collected a proper amount and instead of properly applying it has paid unearned dividends, about all that can be said is that that public utility is in a bad way. It is not fair to the people to fix up several rates of depreciation, one to use in valuing plant, another to use in getting operating expenses, etc. What has happened is that part of the value of the plant has been improperly divided up among individuals, and capital should be written off in the same proportion.

Under ideal regulation the public utility would have been forced to collect enough money to balance depreciation and to spend that money properly on the plant, keeping its value constant.

Now comes the most interesting feature of the business. Nobody can say with certainty just what the depreciation will be each year. A board of public utilities must therefore allow an ample rate of depreciation—which means too large a rate. This also means that the public pays money into the depreciation fund faster than the property actually depreciates and that as the depreciation fund is expended the plant grows more valuable year by year. Proper public regulation of a successful utility will therefore mean a con-

stantly increasing plant, bonds absolutely secure, gilt-edged stock issues, fixed capitalization (except as new capital is put in) and constantly decreasing rates to the public.

As to the manner in which depreciation takes place, the exact shape of the depreciation curve, etc., all of these matters are controversial and not susceptible of positive determination in any particular case. Is it not best to get, as closely as can be done, the average expectancy of life and assume a straight-line depreciation based on life? The process is simple and probably as accurate in the end as any other.

New York, N. Y. GEO. L. HOXIE.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

The Best Proportion of Copper to Iron in Transformers.—C. FELDMANN AND A. C. LOOS.—In the last few years several papers have been published on the design of transformers, the results of which are not in complete accord with the commercial designs. Moreover, some of the results contradict each other. Thus Pohl and Bohle conclude that the total expense for iron and that for copper should be equal, while Pichelmayer finds that the total copper cost should be a little higher (20 per cent as maximum) than the total iron cost. The present authors have developed further the method of Pohl and Bohle so as to take into account all considerations and reduce the calculations as much as possible. The problem is to find the best dimensions for a transformer with an efficiency above a given value so as to make the cost a minimum. The general formulas are developed and applied to a numerical example. The authors first discuss the design of small transformers. One of their conclusions is that if the best dimensions in the calculation give a sufficiently high efficiency, but not sufficiently large cooling surface, it is in general cheaper to increase the cooling surfaces by modifying the best dimensions found by calculation than it is to reduce the losses and thus increase the efficiency. Finally the special points which must be considered in the calculation of large transformers are discussed.—*Elek. u. Masch.* (Vienna), Sept. 3 and 10.

Leakage Reactance of Transformers with Concentric Windings.—J. REZELMAN.—The author tests experimentally a 15-kva transformer by the same experimental method which he has used in analogous cases to test the usual formulas for the leakage reactance of transformers with concentric windings. One of the practical results obtained is a correction in the usual formulas, since the short-circuit test shows that the stray flux proper of the secondary winding is practically negligible compared with the primary stray flux. He also discusses the regions where the stray flux is superimposed on the main flux.—*La Lumière Elec.*, Sept. 9.

Rotor Ventilation.—A note on a recent British patent (30,233, Sept. 7, 1911) of the British Thomson-Houston Company (General Electric Company of this country). Ventilating spaces are provided with channels extending from one part of the periphery to another. The ends of these channels are arranged at different angles to the radial lines, so that the forces tending to throw the air out of the rotor are different at the two ends of the channels. By this method it is claimed that the windage losses are avoided and the rotor diameter reduced.—*Lond. Elec. Eng'ing*, Sept. 14.

Balancing Transformer.—R. NEUMANN.—A paper on a method of C. P. Steinmetz for converting an unbalanced three-phase system into a balanced system by means of a single three-phase transformer with adjustable number of windings. The present author shows that this method may be easily explained by diagrams with the aid of a number of little-known theorems of plane geometry. These theorems are first stated and proved and then applied to Steinmetz's method.—*Elek. u. Masch.* (Vienna), Sept. 10.

Transformer Diagram.—MOELLINGER AND GEWECKE.—A mathematical paper in which the authors develop a simple diagram by means of which after a no-load test, a short-circuit test and a resistance measurement it is possible to find quickly the ratio of transformation and the phase difference between the primary and secondary voltages at all loads.—*Elek. Zeit.*, Sept. 14.

Measuring Slip.—A. BRUCKMANN.—An illustrated English translation of his article abstracted some time ago in the Digest on stroboscopic methods of measuring the slip of induction motors.—*Lond. Electrician*, Sept. 15.

Lamps and Lighting.

Radiant Efficiency of Arc Lamps.—H. P. GAGE.—An account of an experimental investigation the object of which was to determine the radiant efficiency and the mechanical equivalent of the light from the right-angle electrode arc (that is, an arc between two electrodes placed at a right angle) and the Bremer flaming-arc lamps. In discussing the limits of visibility the author shows that the A line 0.76 μ is not a suitable point to take for the limit of the visible spectrum. Examination of luminosity curves shows that it would be preferable to assume this limit to be at 0.68 μ. If all radiation of greater wave-length than 0.68 μ be removed the resulting decrease in light can be neglected. The measurement of radiant energy was made with a radiomicrometer. The kick, or ballistic, method was used. The kick is proportional to the final deflection and to the energy. The calibration of the radiomicrometer in absolute units, using the Nernst filament and the Hefner lamp, showed a general agreement between the energy of the Nernst filament as calculated from the energy input and as derived from Angström's value of the radiation from the Hefner lamp. A modification of the method of Angström was used to determine the radiant efficiency of the right-angle electrode arc, the yellow-flame arc and the white-flame arc. The greatest efficiency was found in the arc stream between yellow-flame electrodes, the electrode tips being shaded. With this arc the light energy constitutes 39 per cent of the energy radiated. The highest efficiency from black-body radiation is from the positive crater of the carbon arc. An efficiency of from 8 per cent to 12 per cent may be expected from this source. Calculations of the mechanical equivalent of light from these data show that 1 watt can produce as high as 30 cp of white light and 39 cp of orange light (yellow-flame electrode). This is much higher than has previously been supposed except from the data of Angström, which give 21.3 cp per watt when recalculated for the limit 0.68 μ.—*Phys. Review*, August.

Mechanical Lamp Tester.—In French railway stations metallic-filament lamps are largely used, but on the trains themselves carbon lamps have been retained. However, tests will be made to determine the suitability of the new types of metallic-filament lamps under the conditions of railway service. For this purpose Mr. Vincent, of the Western Railroad Department of Paris, has designed a simple apparatus for testing incandescent lamps by subjecting them to repeated shocks. The device used for the purpose is shown in Fig. 1. The lamp is fitted into a socket which is mounted upon a small board *A* hinged at one end, while the other end is movable and is actuated by a cam *B* fixed to the shaft *C*. Each time the cam revolves the end

of the board is dropped down, thus giving a definite shock to the lamp. By means of a spring *D* the amount of this shock can be adjusted and made heavy or light. The shaft is driven by a small electric motor and carries at its further end a counter so that the number of revolutions can be read off. For testing the filament when burning normally or otherwise heated by the current the method shown in Fig. 2

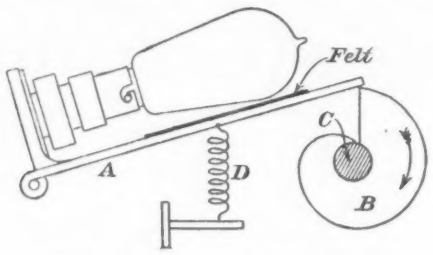


Fig. 1—Diagram of Lamp Tester.

is used. Current from the mains first passes to the motor and to the lamp which is in parallel with it. In series with the lamp, however, is a solenoid *A* of very low resistance. This solenoid normally holds up the main switch *BC*, but should the lamp filament break the current through it will fail and the core will drop and thus open the switch in the motor circuit. The motor then stops and the number of shocks which the lamp has withstood can be read off on the counter. In order to test the lamp when the filament is cold the following method is employed: A small current is passed, which simply acts as a detector and shows whether the lamp is broken or not. In this case, too, the current is

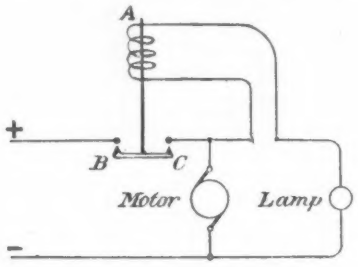


Fig. 2—Connections for Hot Tests.

passed through the lamp for a short time during each revolution. The same apparatus as that described above is used except (see Fig. 3) for an extra rotating contact maker, which carries a long segment *D* and a short segment *E*. For the greater part of a revolution the current passes through the solenoid and not through the lamp and for a short time it passes through the solenoid and the lamp in series. The time is too short to cause the lamp to become heated by the current and the solenoid normally keeps its core held in position. Should the filament be broken the current fails in the solenoid for an instant and this suffices for the core to drop and open the switch. In any case the

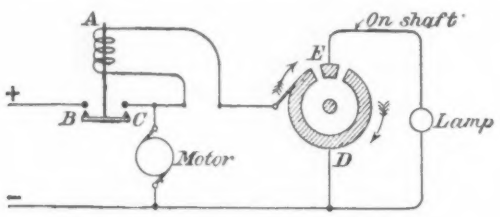


Fig. 3—Connections for Cold Tests.

apparatus goes on working without needing any attention, so that it can be left to itself and the number of shocks is always exactly recorded at the end of any length of time.—Lond. *Electrician*, Sept. 22.

Multiple-Filament Incandescent Lamp.—A note on a recent British patent (1907, Sept. 7, 1911) of Messrs. G. F. Richardson and R. J. Crowley. A lamp in which two or more filaments are used has one end of each connected to a common contact plate at the bottom of the lamp, which is insulated from two other contact plates to which the other ends of the filament are attached. A bridge piece, half of which is insulated and half conducting, is rotatably fixed in the lamp stem, making contact with the two plates, so that the filament which makes contact with the insulated part of the bridge piece is cut out of circuit. It can, however, be switched in by rotating the bridge. The plungers in the lamp socket are always in contact with the common contact plate and the bridge when the lamp is in position.—Lond. *Elec. Eng'ing*, Sept. 14.

Black Body.—R. A. Houstoun.—In a continuation of his long serial on studies in light production the author now deals with the theory of the black body and the fundamental laws of radiation.—Lond. *Electrician*, Sept. 15.

Installations, Systems and Appliances.

British Central Station.—An abstract of the financial report of the West Ham municipal electric station for last year. There is great progress over the previous year. The output for private lighting has increased by no less than 15.6 per cent. In view of the extensive use of metallic-filament lamps this indicates that the use of electricity for lighting is making rapid strides. Motor service and heating show the large increase of 24.2 per cent and now are the predominating factor in total output, accounting for 14,518,555 kw-hours out of 22,690,266 kw-hours sold for all purposes. The other items included in this total are: Traction, 5,182,257 kw-hours; private lighting, 2,253,904 kw-hours, and public lighting, 735,550 kw-hours. While the revenue per kw-hour has remained practically constant for lighting—namely, 5.56 cents, as against 5.58 cents a year ago—there is an increase in the revenue per kw-hour received from the motor service sales. The average price obtained for motor service was 1.20 cents per kw-hour, compared with 1.16 cents in the previous year. The total generating cost per kw-hour sold was 0.68 cent; the distribution cost, 0.10 cent; the management cost, 0.12 cent; total cost, excluding capital charges, 1.18 cents, and including capital charges, 1.90 cents, while the total revenue was 1.98 cents per kw-hour. Hence there was a surplus of 0.08 cent per kw-hour against a deficit of 0.08 cent last year.—Lond. *Electrician*, Sept. 15.

Electric Heating and Cooking Apparatus.—A. Steinhardt.—The first part of an illustrated paper presented before the German Association of Electrical Engineers. The author first reviews briefly the different systems of heating by electricity and then describes typical commercial heating and cooking apparatus. The paper is to be concluded.—*Elek. Zeit.*, Sept. 14.

Wires, Wiring and Conduits.

Two-Point Lamp Control.—It is found desirable to have a lamp, for instance, in the sleeping-room, controlled from two points of the room, or a lamp in a hallway controlled from a switch in the hallway and also from a switch in an

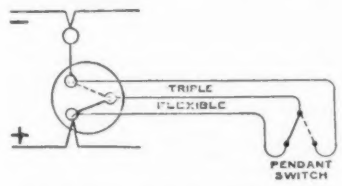


Fig. 4—Diagram of Connections

upper floor. A description is given of a method of Mr. A. P. Lundberg for converting the ordinary single-way switch control to one giving control from two points without any disturbance of the wiring. The conversion simply involves the substitution of a two-way surface switch for the single-way one. A hole is bored in the wood block and a triple flexible led off from the switch on porcelain buttons, or

through insulated screw eyes, to the desired extension point, consisting of a two-way pear switch for bedroom use or one of surface pattern for ordinary use. The simplicity of the adaptation is shown in Fig. 4, where it will be noticed that the leads are not interfered with in any way when making the change and that, contrary to usual custom, the "common" terminals of the two-way switches are interconnected. To leave the switch point as it was originally is a simple matter, the two-way switch being made to act as a single-way one by short-circuiting two of the terminals, the flexible and extension switch being disconnected. This provides for the case of the obstinate landlord who requires the installation left as it was found.—Supplement Lond. *Electrician,* Sept. 15.

Wireless Connecters for Cookers.—D. S. Monro.—The author points out that for electric cooking installations in residences flexible connections represent a source of nuisance. He describes a system of wireless connections which he has devised. Single heaters with two plugs or triple heaters with three plugs may be used, and it is necessary to fit the heaters with standardized parallel prongs, say ¼ in. in diameter and with centers ¾ in. from the base. The prongs may be about 2¾ in. long for large heaters and 1½ in. long for small ones and have, say, 1½-in. centers. A metal or wood table, or shelf, may be used, so long as the surface is faced with metal, usually zinc. The surface is "earthed." On the top of the table are screwed two lengths of grooved and polished slate. These form a casing and cover for the cables and also carry the contact sockets. Tube contacts are fixed at intervals across the seam between the two slabs of slate. These contacts consist of pieces of tube brazed to small terminal blocks. The blocks are held in the grooves of the slate and hold the contacts firmly without further fixture. The tubes present a perfectly smooth and uninterrupted channel for cleaning-out purposes. The negative cable is carried in a groove in the upper slate and is looped through its negative contact terminals. The positive is carried in a groove in the upper slate and is looped through the switches which sit on the top of the slate. Switch wires pass through holes to the positive contact tubes. The method of wiring a single circuit feeding one two-socket and one three-socket connection is shown in Fig. 5. Fig. 6 shows a cooking table prepared for kitchen use, with replaceable fuse and "earth" connection. The inner surfaces of the two slates are so cut that when they are screwed together and to the table there is no possibility of water getting through the seam into the cables. The upper slate has vertical grooves to guide the prongs of the cookers into their sockets, and, of course, as the prongs are inserted the metal bottom of the vessel makes a sliding and good electrical connection with the earthed table top. The ends of the contact tubes do not project to the surface of the slate, so when the vessel is withdrawn it is quite free from contact with the circuit, even should the switch be accidentally left in the "on" position. There is, therefore, no possibility of shock. The design of the tube contact sockets is shown in Fig. 7. The positive and negative tube sockets are of the same simple type and are interchangeable.—Lond. *Electrical Review,* Sept. 15.

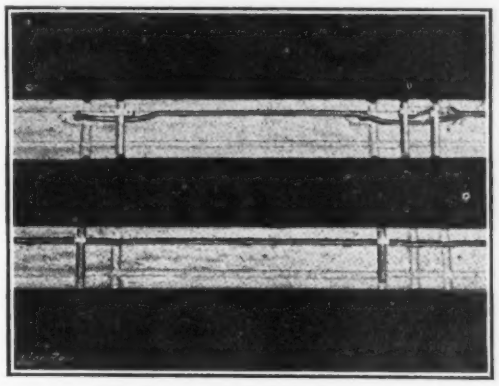


Fig. 5—Method of Wiring.

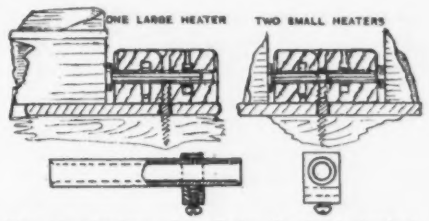


Fig. 7—Design of a Tube-Contact Socket.

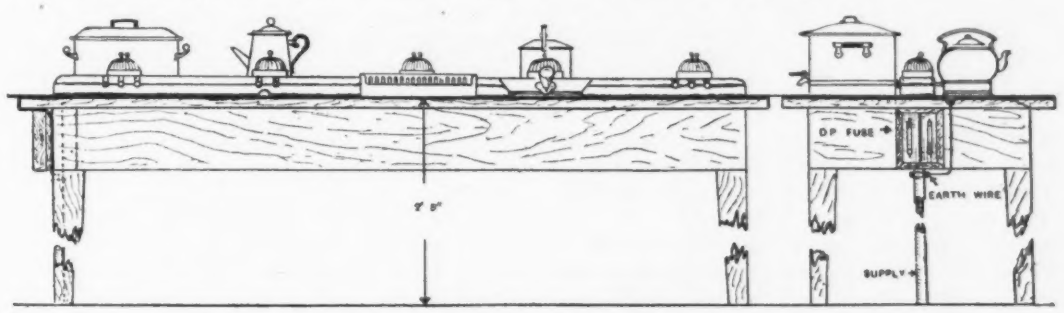


Fig. 6—Cooking Table with Replaceable Fuse and Earth Connections.

Electrophysics and Magnetism.

Impedances in Parallel.—J. Herzog.—The first part of a paper giving a series of diagrams and geometrical theorems for the graphical representation of all the numerous problems concerning the parallel connection of resistances, inductive reactances, capacity reactances and impedances in general.—*Elek. u. Masch.* (Vienna), Sept. 17.

Brownian Movements.—H. Fletcher.—A paper in which the continual agitation of a small particle suspended in a gas, known as the Brownian movements, is entirely explained by the kinetic theory of gases, both qualitatively and quantitatively. The value of the fundamental electric charge obtained from gaseous ionization is the same as that obtained from electrolysis. The irregular values of e apparently resulting from the work of Ehrenhaft and Przibram are entirely explained by the Brownian movement theory.—*Phys. Review,* August.

The Age of the Earth.—J. Joly.—The recent contributions to the data bearing on the subject of the age of the earth have strengthened the evidence derived by two very different methods of computation; that based on the study of solvent denudation and that based on the accumulation of radioactive waste products in minerals. While the indications of both lines of inquiry seem individually rendered more definite by these advances, the divergence in their final results has, if anything, become intensified. The author reviews critically the opposing methods and discusses the possibility of their reconciliation. In view of the great difficulties which he finds in endeavoring to get such a reconciliation he questions the foundations of the radioactive method. The fundamental assumption is that the

parent radioactive substance, uranium, has always in the past disintegrated at the present rate. He suggests that possibly there may have been a different and a greater rate of decay in the past. In this case the accumulation of transformation products in minerals, in place of being a measure of geological time, serves to shed light upon the rate of transformation of the primary radioactive bodies in the past.—*Phil. Mag.,* September.

Fluorescent Röntgen Radiation.—C. G. Barkla.—When substances are exposed to Röntgen radiation they emit X-radiations of two distinct types. One of these radiations, like the primary in penetrating power and general properties, has been termed the scattered radiation, being analogous to light scattered from small particles. The other, a completely transformed X-radiation, has been termed the characteristic secondary X-radiation, the homogeneous secondary X-radiation, and latterly and preferably the fluorescent X-radiation, on account of its similarity to fluorescent light. The author discusses at length the characteristic features of fluorescent X-radiation. He deals at length with the evidence of its homogeneity. Unlike the scattered radiation the fluorescent radiation is uniformly distributed around a polarized beam of X-rays. It is also uniformly distributed in a plane containing the direction of propagation of the primary radiation. Thus the intensity is entirely independent of the direction of electric force or of propagation of the exciting primary beam. Each element has its own charactertistic fluorescent line spectrum in X-rays. This is very conveniently represented as in a spectrum of ordinary light, except that without a knowledge of the wave-length it is necessary to define the radiations by their absorption in some standard substance. "It is scarcely too much to say that all the phenomena connected with the transmission of X-rays through matter may be readily explained in terms of a few simple laws expressed with reference to these spectra."—*Phil. Mag.,* September.

Ultraviolet Light from Low-Pressure Discharges.—E. W. B. Gill.—An account of experiments relating to the distribution of the intensity of ultraviolet light emitted from the various parts of an electric discharge at low pressures. The results show a systematic variation with the change of pressure, and the chief result is that after the pressure corresponding to the minimum sparking potential for two fixed electrodes has been passed the character of the discharge is radically changed.—*Phil. Mag.,* September.

Electrochemistry and Batteries.

Resistance and Arc Furnaces.—A note on some experiments made by Mr. W. Conrad on the relative advantages of electric resistance and arc furnaces with special reference to the alleged unsuitability of resistance furnaces for the smelting and melting of iron and steel. Conrad's argument is that, with the practically feasible current intensities, it is out of the question to heat a liquid conductor like iron by using it as a resistance. The ordinary laboratory experiments are made in resistance furnaces rather than in arc furnaces, because the former are more convenient. Laboratory furnaces can be cooled, moreover, when the high temperatures make the walls conductive, but that is hardly possible in practice; hence carborundum furnaces are worked for a time and then dismantled. When the liquid resistance conducts much better than the furnace material the objection that the walls also conduct would not be fatal. But when that is so the liquid conductor does not absorb the electrical energy to a profitable degree. Potential measurements which Conrad made in calcium carbide furnaces, in which arc and resistance heating are combined, convinced him that only 1 per cent of the heat energy consumed was due to the conduction of the current through the mixture, while the arc supplied 99 per cent, and it could be seen that the carbide formation was taking place chiefly where the arc had been playing. In his experiments on iron he filled a furnace with 1300 kg of steel (1 per cent of carbon) after raising the two suspended electrodes. He inserted into the bath two oblique steel rods, 3 m in length and 36 mm in diameter, as test electrodes for the resistance determinations with direct currents. These determinations were made twenty-eight hours and fifty-three hours after filling the furnace; it was found that the gradual heating of the furnace by the fluid metal made very little difference in the resistance values. The cold electrodes had a resistance of 0.000117 ohm per meter; the total resistance of the bath was 0.00085 ohm and 0.00080 ohm (first and second measurements), and the resistance of the bath alone, 0.00027 ohm and 0.00026 ohm. That would yield a specific iron resistance of 22 ohms per meter length and per square millimeter section, and the liquid iron would therefore conduct only 1/22 as well as mercury and 1/100 as well as cold iron. This conductivity of the iron was really lower than one should expect, supposing the resistance of iron with rising temperature to increase at the rate shown by ordinary experiments. But in any case the resistance would be far too low for efficient resistance heating. Since the liquid iron is no longer magnetic, it is the I^2R heat which is of moment, and for this particular arc furnace, which is fed by two arcs in series at 3000 amp and 110 volts, the 0.00027-ohm resistor would absorb only 2.4 kw, which means 0.73 per cent of the amount that the two arcs could supply. The heat generated in this way would be about that of a small iron stove and could easily be balanced by cooling. A resistance furnace with cooled electrodes would therefore be apt to lose more heat through the electrodes than they could introduce, and to secure efficient heating currents of enormous intensity would be required. These considerations would affect direct-resistance steel furnaces of the Gin and also of the Girod types. Conditions are more favorable with induction furnaces and also with furnaces of the Roechling-Rodenhauser combined induction and resistance heating type, in which electrodes of large surface, covered with a layer of material which conducts only when hot, are embedded in the furnace bottom for direct auxiliary heating of the bath.—Lond. *Eng'ing,* Sept. 15.

Units, Measurements and Instruments.

Analysis of Periodic Curves.—J. R. Ashworth.—An illustrated description of a simple graphical method for the harmonic analysis of a cyclic function. Use is made of a simple graphical procedure and a transparent device to reduce the arithmetical calculations as much as possible.—Lond. *Electrician,* Sept. 15.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—P. Brenot.—A very full illustrated description of the wireless telegraph station which is operated on the Eiffel Tower in Paris.—*La Lumière Elec.,* Sept. 2.

Miscellaneous.

Technical Education.—A. Reisset.—With reference to the recent French paper of Le Chatelier on higher technical education, the author gives a review of a paper on the same subject by Meyer before the Association of German Engineers and of the discussion recently held in London before the Society of Civil Engineers. It is thought that a crisis has been reached now in the problem of technical education and that this crisis is international.—*La Lumière Elec.,* July 29, Aug. 12.

Presidential Address.—P. Rosling.—In his presidential address to the Victorian Institute of Electrical Engineers the author deals especially with the practice of combination of professional work with contracting work, which he condemns. He then urges the Institute to take in hand the education of the electricity committee of the Melbourne municipal electric station on the question of rates for motor service and heating service.—Lond. *Electrician,* Aug. 25.

Book Reviews.

The Design of Static Transformers. By H. M. Hobart. New York: D. Van Nostrand Company, 1911. 174 pages, 101 illus. Price, $2.

Gisbert Kapp and Prof. J. A. Fleming supplied the profession a dozen years ago with the earliest treatises on the design, efficiency and operation of transformers. Though there appeared within that period a fairly extensive literature on the subject, mainly in the form of articles and papers published in technical journals, the number of works dealing more or less fully with one or other aspect of the subject is but small. In the present volume Mr. Hobart supplies a much-needed manual on the design, construction and regulation of transformers of various types. After a lengthy introduction, in which matters of general interest are touched upon, the author adds a bibliography of useful papers which may be read with understanding and profit by the student after perusing the present short treatise. It is to be regretted that the author saw fit to qualify the apparatus treated by the word "static," which word carries one back to the days of unscientific nomenclature long since revised.

Electric Central Stations. Distribution Systems: Their Design and Construction. By Harry Barnes Gear and Paul Francis Williams. New York: D. Van Nostrand Company, 1911. 374 pages, 139 illus. Price, $3.

The treatment of the subject of this volume implies a general knowledge of electrical theory, but much may be profitably studied by practical men who have not had a full technical training. The matter covered relates to voltage regulation, line transformers, protection apparatus, overhead and underground construction, alternating-current circuits and distribution economics.

Physical Significance of Entropy. By J. F. Klein. New York: D. Van Nostrand Company. 98 pages. Price, $1.50.

A somewhat philosophical disquisition, as distinguished from an arithmetical discussion, on the subject of entropy and of the second law of thermodynamics. It requires some study of the book to find a definition of what is meant by the term "entropy," although the whole book is devoted to the subject. The following are, however, statements tending to define the term as quoted from page 41:

(*a*) Entropy is a universal measure of the "disorder" in the mass points of a system.

(*b*) Entropy is a universal measure of the irreversibility of a state and is its criterion as well.

(*c*) Entropy is a universal measure of Nature's preference for the state.

(*d*) Entropy is a universal measure of the spontaneity with which a state acts when it is free to change.

These statements are presumably irrefragable, but they are somewhat metaphysical and suggest the order of ideas contained in the longer catechism. If a few arithmetical illustrations were employed in the book of the way in which entropy is used by engineers it would help the average technical reader.

It is curious that the growth of literature purporting to answed the query "What is entropy?" only serves to obscure further the physical significance of the term—which appears to indicate that the mathematical formula which represents entropy has no actual physical significance.

New Apparatus and Appliances

A METHOD OF OVERCOMING PEAK-LOAD TROUBLES.

Those who have studied the peak-load problem will be interested in a novel solution which has been quite successful in the municipal lighting and water-works plant of the city of Lachine, Canada. In this instance the low cost and satisfactory operation of a 400-hp steam turbine unit are utilized in effecting the economy. In the Lachine plant a 14-in., two-stage, double-suction turbine pump, with a capacity of 6,000,000 gal. per twenty-four-hour day, is utilized to provide water supply and fire protection for the city, the water pressure being ordinarily 80 lb. per square inch and for fire 120 lb. per square inch. Energy is purchased by the year on a basis which is all right for lighting the city and for pumping at all times of the year except the three winter months, during which the lighting load is greatest. It was figured that operating the pump by steam for four or five hours a day during that period could be made less expensive than buying sufficient electrical energy to operate entirely by electricity. As further advantages of an auxiliary steam installation the insurance rate on the pumping station could be reduced and the city could be better lighted during fall evenings without incurring unreasonable additional expense. It was therefore decided to arrange the pump for operation by a 400-hp induction motor the greater part of the time, but by a steam turbine during the peaks in the lighting load in winter and in case of accident in the electric line. The installation was supplied by the John McDougall Caledonian Iron Works, Montreal. The pump, of Worthington make, runs at 900 r.p.m. and is direct-connected to an Allis-Chalmers-Bullock motor on one side and a 400-hp four-stage Kerr turbine on the other. Either driving unit can be thrown into or out of use instantly by means of clutches on the shaft.

A GUY CLAMP WITHOUT BOLTS.

A guy clamp that is said to eliminate some weak points in bolted guy clamps and which, it is stated, can be installed

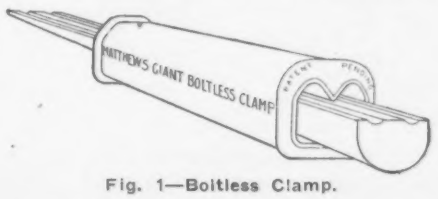


Fig. 1—Boltless Clamp.

in one-tenth of the time used for installing a three-bolt clamp has been put on the market by W. N. Matthews & Brother, of St. Louis.

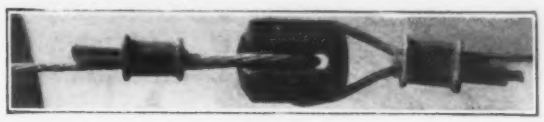


Fig. 2—Boltless Clamp Installed.

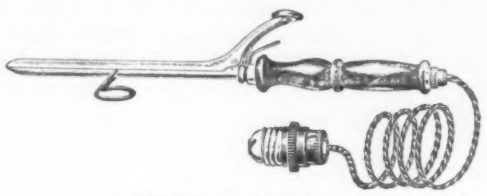
In installing a boltless clamp, illustrated in Fig 1, the sleeve is slipped over the end of the strand, then the strand is wrapped around the pole or a loop made through

the anchor eye, whence the wedge is driven in toward the pole on the anchor. It is said the strand will break before the clamp will slip.

The clamp is made in two sizes, the smaller fit for ¼-in. to 5/16-in. strand inclusive and the larger for 5/16-in. to 7/16-in. strand inclusive.

ELECTRIC CURLING IRON.

A feature of the design of the new electric curling iron recently developed by the Pelouze Electric Heater Company, 232 East Ohio Street, Chicago, is the readiness with which it quickly attains a temperature ready for use, although it is impossible for the heating element to become hot enough to burn the hair. While the efficiency of an electric curling iron is not relatively important, since its total energy consumption is small, the demand of the Pelouze iron has been reduced to a point, 20 watts, which will not operate many meters. The iron can be left in circuit indefinitely, it is said, without becoming overheated. Several improvements incorporated in the construction of

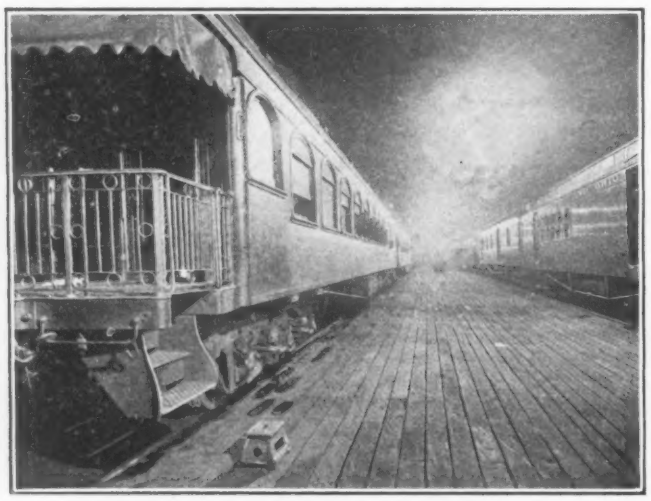


Electric Curling Iron.

the cord and handle of the new iron also obviate cord troubles. The heating element in the iron is free to revolve so that the entire system of cord and heater rotates inside the handle and stem of the device. The Pelouze curling iron weighs 7 oz.

LUMINOUS ARC LAMPS FOR RAILROAD TERMINALS.

The adequate illumination of railroad terminals presents many difficulties not encountered elsewhere. The prevalence of smoke and steam and the presence of light-absorb-

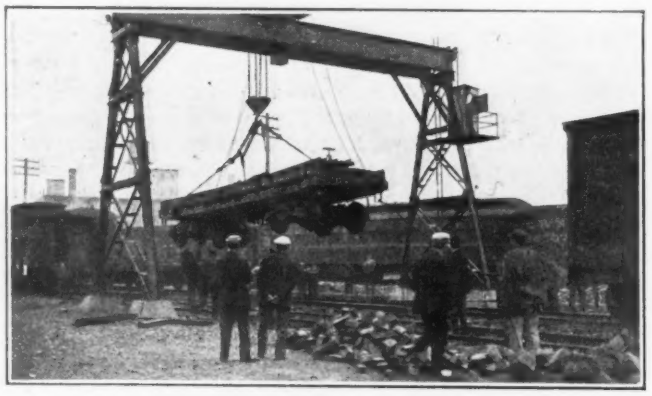


Illumination of Train Shed by Luminous-Arc Lamps.

ing deposits of soot and cinders require the use of light units of high intrinsic brilliancy, large volume and great penetrating power. For this class of service multiple luminous arc lamps are particularly suitable in that the light is emitted from the entire arc stream and, consequently, is of much greater volume than that of the arc lamp in which the arc is practically non-luminous and the source of light is limited to the incandescent tips of the carbon electrodes. Another feature, which enhances the value of these lamps for use in smoky places, is the location of the reflector inside the inclosing globe, thereby effectually removing it from the tarnishing effects of the moist and dirty atmosphere.

RAILROAD ELECTRIC CRANE.

The accompanying illustration shows a 20-ton electric crane which has just been erected over the Allentown Terminal Railroad tracks at Allentown, Pa. The crane has a

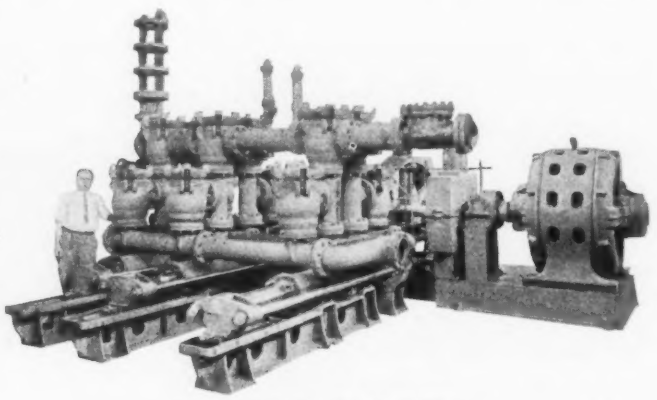


Electric Crain Lifting a 22-Ton Load.

38-ft. span and a 12-ft. driveway. The illustration shows a test which was made Sept. 19, when a 15-ton gondola car containing 7 tons of rails was lifted. This made a total of two tons over the rated capacity of the crane, which was made by the Mar's Brothers Company, of Philadelphia.

LARGE ELECTRICALLY DRIVEN MINE PUMP.

The El Oro Mining & Railway Company, of El Oro, Mexico, has just installed what is said to be one of the largest motor-driven pump equipments ever built for unwatering a mine. The pump, which was built by the Goulds Manufacturing Company, Seneca Falls, N. Y., has a capacity of 500 gal. per minute. The construction is such that the pump can be readily dismantled and lowered down an ordinary mine shaft, and when assembled it requires very

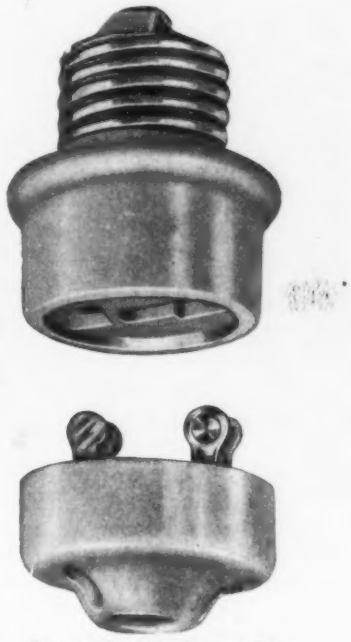


Electrically Driven Mine Pump.

little head room. The pump will be installed in the bottom of the mine and will work against a head of 1300 ft. The driving motor is a 200-hp, three-phase, 50-cycle, 440-volt, 485-r.p.m. Westinghouse machine, connected with double-reduction gearing giving the crank shaft of the pump a speed of 35 r.p.m.

NEW SEPARABLE ATTACHMENT PLUG.

Where attachment plugs are used with lighting fixtures considerable side strain is put on the fixture, because the cap of the ordinary separable attachment plug will not separate except when pulled straight out from the base. The plug illustrated herewith, made by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., has an effective locking arrangement to hold the cap in place, but separation can also be effected by pulling in any direction. This prevents the injurious side strain on the fixtures. The area of contact provided is large, and the screw shell is



Separable Attachment Plug.

securely attached to the porcelain by two screws, so as not to be pulled off through carelessness in screwing the plug into the socket or receptacle too tightly, as in the case where only one screw or rivet is used. The rating is 660 watts, 250 volts. Two styles are made, one having a porcelain cap and the other a cap of black composition. The base in both cases is porcelain.

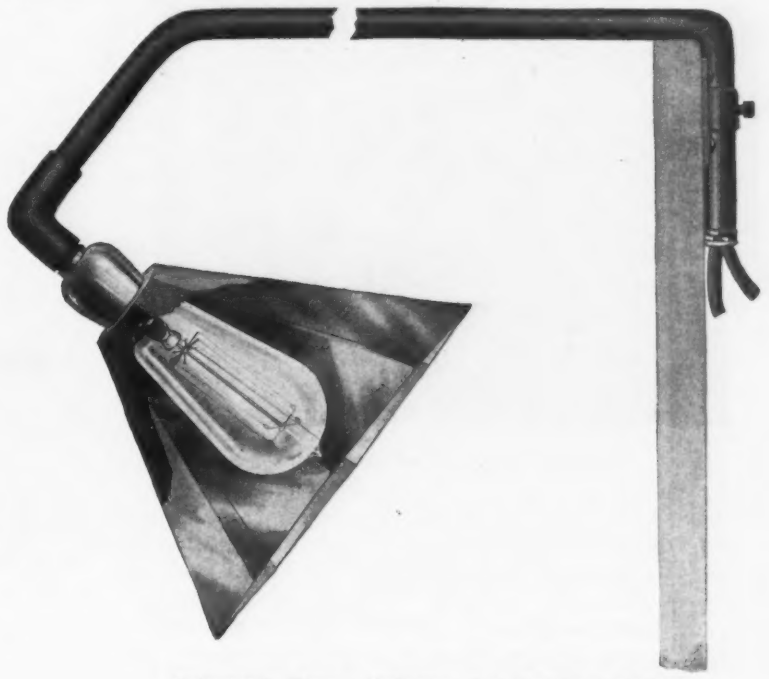
A HURRY-UP MOTOR-SERVICE INSTALLATION.

With the first coming of a recent hot spell the Kansas City Breweries Company found itself in urgent need of 125 hp additional motor service to drive its refrigerating machinery. On Thursday morning the Kansas Electric Light Company was appealed to for this power, but it was found that a motor-generator set would be needed to deliver the direct-current pressure employed at the brewery. No such machine could be located in Kansas City, and telephone messages to St. Louis and Chicago proved likewise fruitless. Finally a 90-kw set was run down at Schenectady, N. Y., ready for shipping, and a telegram to the New York officials of the express company urgently requested them to have a special car in Schenectady the following morning for the 7-ton shipment. All this happened on Thursday.

Friday morning this special car left Schenectady. It was transferred at Chicago on Saturday and reached Kansas City Sunday noon. In two hours the car had been delivered to the brewery sidetrack by a special switch engine and the machine was being unloaded. Meanwhile the service lines had been run to the plant, a switchboard, complete with instruments, meters, etc., was installed and connected up, and by Monday midnight the new motor-generator set was in service—four and a half days after the customer had placed his order.

BILLBOARD LIGHTING.

Illuminated billboards or bulletin boards are increasing in number, and to meet the demand for a reflector especially designed for this class of illumination the Reynolds Electric Flasher Manufacturing Company, of Chicago, has brought out what it calls the "Reco" mirror reflector.



Octagonal Mirror Reflector for Billboard Lighting.

The reflector is octagonal in shape, and this, it is said, causes the light to be diffused evenly to every part of the sign or surface to be lighted. The interior of the reflector is lined with mirror glass, reflecting all of the light from the lamp. Glass, having a smooth surface, does not tend to accumulate as much dirt as painted reflectors or enameled reflectors. Furthermore, it may be cleaned easily.

Since the introduction of the tungsten lamp there has been a considerable movement in favor of illuminated signboards. This form of sign advertising is effective both day and night and it has the added advantage that it helps to light sidewalk and street. Many municipalities are said to favor illuminated billboards. The average cost of electrical energy with this reflector is said to be less than 1 cent an hour for each 100-watt tungsten-lamp unit. The reflector is made of galvanized iron, thoroughly reinforced, and is provided with a heavy waterproof brass socket.

INERTIA GEAR FOR CORLISS ENGINE VALVES.

A new type of admission valve mechanism, styled the "inertia gear" by its designer, Mr. Ernest A. Moore, chief engineer of the Bates Machine Company, Joliet, Ill., and now regularly used on all Bates Corliss engines, is offered to overcome inherent faults of existing types of admission valve gears. With this gear the disengaging parts, instead of being forced into and held in their path by springs, rollers or other devices, travel in the desired path by natural forces involved in the movement. The dashpot arm is in the form of a bell crank, one arm carrying the dashpot rod and the other the catch block. The arm is keyed to the valve stem and a sleeve on its inner side fits into a bored

recess in the steam bonnet, thereby gaining great bearing surface. The steam arm is driven by the valve rod in the usual way. A substantial boss on the steam arm carries the latch shaft, on the inner end of which is firmly mounted the knock-off bar, these two parts forming practically one solid piece of steel.

The knock-off ring is controlled by the governor and carries the knock-off cam and safety cam. The latter comes into operation only in the event of some mishap to the governor, when the cam is thrown into such a position

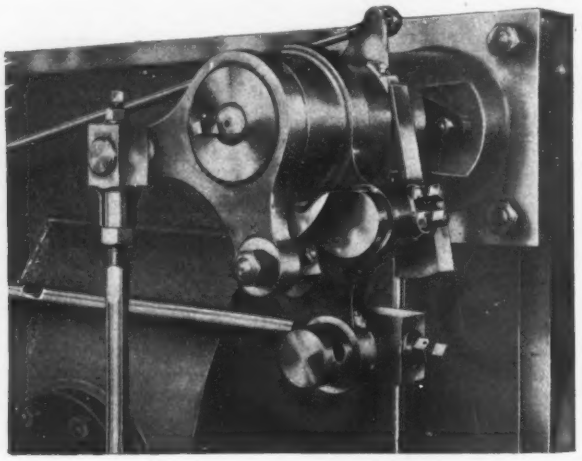


Fig. 1—Corliss Valve Mechanism.

that the valve cannot be opened. The operating movements are as follows: In opening the valve the valve rod moves to the left, the latch shaft engages with the block and continues in this path until the knock-off bar comes into contact with the knock-off cam and is forced outward, raising the latch until the block is released. The dashpot then comes into action and returns the arm to which the block is attached to the original position. The follower pin is firmly fixed to the steam arm and acts only in the event of the dashpot failing to close the valve. The construction and balancing of the latch shaft and its knock-off bar attachment are such that the inertia due to the reciprocating motion and the gravity of the parts assures an automatic latching action at the end of the return stroke between shaft and block without the use of any spring or mechanical device of any kind, and in turn assists the unlatching at the point of cut-off, thereby reducing the reaction on the governor. The depth of the latching and the amount of clearance of the catch blocks may be set to a nicety and with the greatest ease while the engine is running full speed.

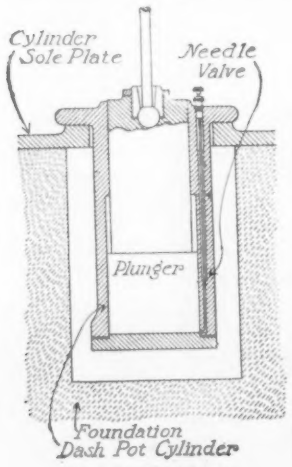


Fig. 2—Dash Pot.

This arrangement is accomplished by the two adjusting screws. This valve gear has been tested and found to work positively and quietly up to the limit speed of vacuum dashpots, considerably over 250 r.p.m. The dashpot now used on Bates Corliss engines is also of special design and is said to be remarkable for quick action, noiseless operation and durability. It is set beneath the soleplate, is made without packing or leather of any kind, and the method of cushioning enables it to act over the wide range of lifts without there being any necessity for adjustment.

DIRECT-CURRENT MOTOR STARTERS.

The Allen-Bradley Company, of Milwaukee, has placed upon the market a new line of direct-current electric motor starters, to be used for automatically starting shunt, series

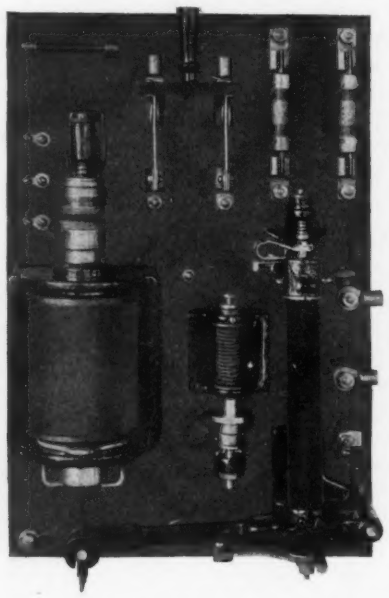


Fig. 1—Direct-Current Motor Starter.

and compound motors. They are especially adapted for starting motors under heavy load. Simplicity, durability, reliability and compactness are claimed as features of this machine. The motor is started by simply closing the line switch and the starter will automatically accelerate the motor to full speed. The operator is not called upon to exercise either skill or judgment, even when the motor is started under a very heavy load. For this reason these starters are very desirable when ignorant help must be relied upon to start motors.

These devices are of the Allen-Bradley carbon compression type, the resistance being secured through the imperfect contact between the surface of prepared graphite disks,

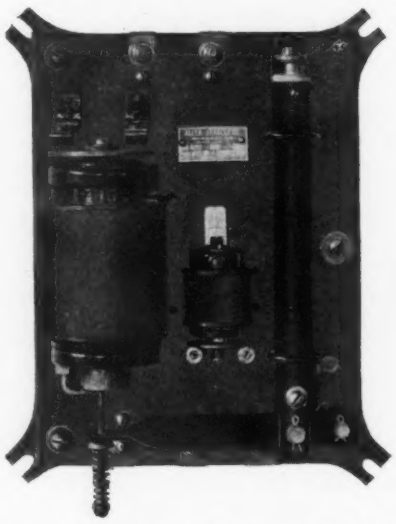


Fig. 2—Direct-Current Motor Starter.

piled in a column. This contact resistance varies with pressure, and the resistance changes are caused by subjecting the column to various degrees of pressure. The columns of disks are inclosed within an insulated steel tube, which is provided with suitable terminals and plungers for transmitting the pressure to the disks. Such inclosed columns constitute a complete resistance unit. These graphite disks

are well adapted for rheostatic service, as they will not crush or break, are not affected by any temperature that they have to encounter, cannot be fused, will not corrode, and are not changed to any considerable degree by years of service.

The operation of this machine is as follows: When the main switch is closed, the motor circuit is made through the fuses, resistance unit, current relay and the motor armature. At the same time the solenoid circuit, which is connected directly across the line and takes a current which is a small fraction of one ampere, is closed, and the plunger of the solenoid is drawn up, which produces a pressure on the resistance unit and increases the current in the motor circuit to the predetermined value at which the current relay is set. When this value is reached the current relay operates and opens the solenoid circuit, which reduces the magnetic pull and allows the solenoid plunger to drop back slightly. This action increases the resistance in the motor circuit, which decreases the current sufficiently to allow the relay to close again. Similar cycles of operation are repeated as the motor accelerates, and each time the plunger is drawn a little further into the solenoid, until contacts on the top are pushed together, which short-circuits the current relay and resistance unit, making them inoperative and completing the operation of starting the motor.

In starting the motor with this device the current is always held down to a certain predetermined value, and it is thus impossible to overload the motor by too rapid starting. The current relay is calibrated in amperes, and may be set to suit existing conditions.

OUTDOOR TYPE OIL CIRCUIT-BREAKERS

To meet the demand for a simple but absolutely reliable outdoor-type oil circuit-breaker for moderate capacities and voltages, the Westinghouse Electric & Manufacturing Company has placed on the market a modification of its type B breaker, which has been successfully used as an indoor type for some years past.

The present breaker has a separate tank for each pole, the tanks being made of welded-seam boiler iron with an insulating lining, thus permitting an easy inspection of the contacts. The breaker may be either automatic or non-automatic in the tripping operation. The automatic tripping is effected by the use of series transformers located as an integral part of the circuit-breaker, one transformer for a two-pole breaker, three for a three-pole breaker and two for a four-pole breaker. This arrangement affords absolute protection under all conditions, and the manufacturers do not advise the use of less than three transformers for a three-pole breaker. The breaker is full automatic in its action, that is, cannot be held in closed position while a continued overload or short-circuit exists on the line.

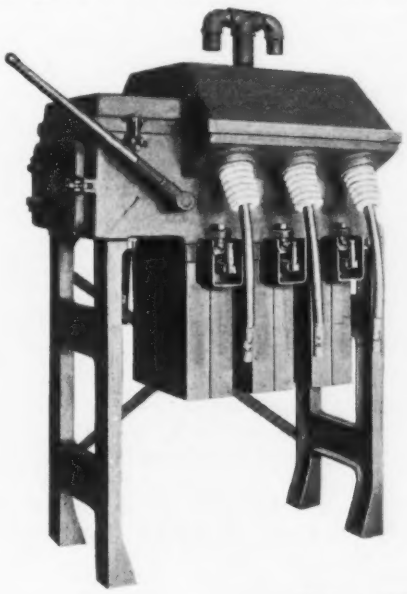
The outdoor hand-operated-type breaker, as shown in the accompanying illustrations, is entirely self-contained and is mounted on a substantial cast-iron frame that can be set in any location and requires no foundation, bed-plate or base. This feature renders the installation of the breaker a very simple and inexpensive matter. The fact that each pole is inclosed in a separate tank renders the inspection of the contact mechanism a very easy matter.

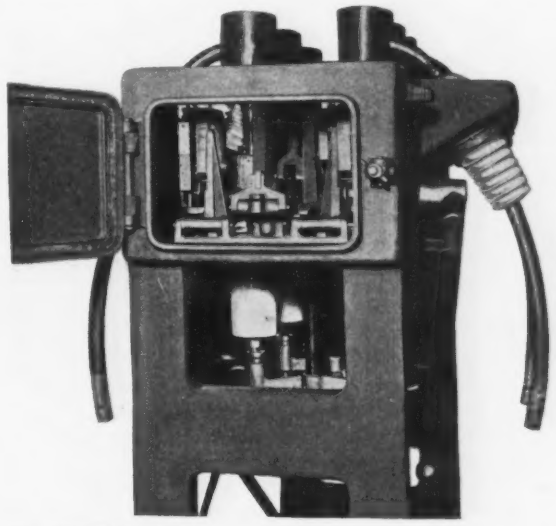
The overload series transformers are mounted within the inclosing case of the breaker, thus being thoroughly protected from the weather and accidental contact with the operator. The leads from these transformers pass directly to the trip coils of the breaker, which are also inclosed in the housing. Insulated leads are brought out through heavy corrugated porcelain bushings, as shown in the illustrations, and are left of a sufficient length to enable connections of any kind convenient to the installation that is about to be made.

Sight gages are supplied on each oil tank for determining the height of the oil and the tank is filled with the oil through a plug located just above the sight gage, so that both of these operations may be performed without removing the tank. In the end of the housing is a hinged cast-iron door fastened by means of a bolt and winged nut, which permits ready access to the calibration mechanism. The breakers are calibrated before leaving the works for the service on which they are to be used. Leads for indicating lamps that show the position of the contacts are brought out on the under side of the case and may be carried to any convenient location for the lamps.

The breakers shown in the views herewith are hand-operated, but are also made for electrical operation.

A wooden closing bar is furnished for closing the breaker, which is inserted in the socket connected to the contact mechanism on any occasion when it is desired to close the breaker, and then removed, the handle socket serving as an indicator of the position of the contacts. A vent pipe with a double opening is attached to the top of the weatherproof housing to permit the escape of gases arising at the time of the operation of the breaker under load. The housing is so constructed that it can easily be removed, permitting a ready inspection of all parts of the breaker; at the same time, when assembled it forms an entirely waterproof compartment. All live metallic parts inside the case are well insulated and any danger of flashing from them to the case is eliminated.





Figs. 1 and 2—Outdoor-Type Oil Circuit-Breakers.

Industrial and Commercial News

The Week in Trade.

PROSPECTS for increased business are improving, and a more cheerful tone is shown in many branches of trade. Retail lines, in general, are showing expansion, and with advancement of the season orders for fall goods are being placed on an encouraging scale. Demand for fabrics of nearly all classes is improving and enlargement in this field is expected, as stocks in jobbing hands are thought to be rather low. More activity is taking place in the textile districts of New England, where many woolen mills are resuming work and others are operating on day and night schedules. Railroads are placing more liberal orders for equipment and several large contracts for cars, locomotives and rails have been let during the week by roads in various parts of the country. It is expected that an increase in orders from the roads will be forthcoming as soon as prices become more stable. Steel output is fairly good as an outcome of price reductions, and the pig-iron market is more active, though in both lines the buying is chiefly for early delivery. Export bookings are helping to expand operations at the mills. The sensational developments in the stock markets last week have had very little effect upon any branches of trade other than steel. The government report on the cotton crop, issued on Monday, indicates the largest output in the history of the country, the estimate placing the total crop at 13,868,337 bales, which, if realized, will be almost 1,000,000 bales in excess of last year's figures, and 200,000 bales in excess of the record output in 1904. Business failures for the week ended September 28, as reported by *Bradstreet's*, were 248, as compared with 236 last week, 211 for the corresponding week in 1910, 195 in 1909, 225 in 1908 and 177 in 1907.

The Copper Market.

SALES to foreign and domestic consumers in the closing days of September showed a slight expansion, in consequence of which the report of the Copper Producers' Association for the month will be a trifle more favorable than had been expected. An increase of at least 5,000,000 lb., however, in the stocks of marketable copper seems certain. Foreign buying increased after improvement in the outlook for settling the Moroccan controversy, and the advance has been maintained this week. Domestic consumers have shown signs of low stocks by calling for delivery of October copper, but with prospects for better prices they continue to buy only from time to time and for immediate shipment. Prices were shaded slightly during the week, and some sales were made to domestic interests at 12¼ cents, delivered thirty days, while some of the export business of the week was closed at 12⅛ to 12.15 cents f.o.b. New York. A firmer tone appeared later in the week and 12¼ to 12⅜ cents delivered thirty days were prevailing prices. London prices advanced slightly from 5s. to 10s. Standard copper in New York was dull throughout the week. Rumors of a copper merger backed by both American and foreign capital have been in evidence, but there is little probability of a consolidation at present. The necessity for a grouping of interests with a view to regulating prices and output is apparent, particularly in view of prospects for increased production expected from some of the refineries. This expected increase forms one of the strongest influences leading consumers to keep out of the market in the hope of lower prices. Although export business has shown a falling off in the past few weeks, the total exports for September were 25,745 tons, making a total of 249,496 for the first nine months of the year, which is an increase of 37,545 tons over the corresponding period in 1910. Exports for the present month, including Oct. 4, are 547 tons. The daily call on the Metal Exchange Oct. 3 quoted copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	11.80	11.90	.....
October	11.80	11.90	11.85
November	11.80	11.90	11.85
December	11.80	11.90	11.85
January	11.80	11.90	11.85

The London market, October 3, was as follows:

	Noon.	Closing.
	£ s d	£ s d
Standard copper, spot	54 17 6	55 13 9
Standard copper, futures	54 18 9	55 15 0

Extreme fluctuations for this year.

	Highest.	Lowest.
Standard	12.35c	11.57½c
London, spot	£57 10 0	£53 7 6
London, futures	58 2 6	54 0 0
Best selected	61 10 0	57 5 0

Industrial and Commercial Notes.

Appalachian Power Company.—Officers of the Appalachian Power Company, which was incorporated under the laws of Virgina in May as previously mentioned in these columns, are: H. M. Byllesby, president; M. A. Viele, Arthur S. Huey, Otto E. Osthoff and Frederic W. Stearns, vice-presidents; Elmer Dover, secretary; R. J. Graf, M. A. Morrison and Robert E. Scott, assistant secretaries; R. J. Graf, treasurer; B. W. Lynch and Herbert List, assistant treasurers. The directors of the company are: H. M. Byllesby, A. S. Huey, J. J. O'Brien, R. E. Scott, M. A. Viele, O. E. Osthoff, H. W. Buck, Elmer Dover and F. W. Stearns. The authorized capitalization of the company consists of $25,000,000 first mortgage, 5 per cent, thirty-year bonds, of which $5,450,000 has been issued; an issue of $15,000,000 7 per cent preferred stock, cumulative from Oct. 1, 1912 and redeemable after three years at the option of the company at 112 and accrued dividend, of which $2,180,000 has been issued; and $10,000,000 common stock of which $6,000,000 has been issued. In addition to the utilties originally purchased, the company has acquired the electrical properties in Wytheville, Va., so that it now owns utilities in Marion, Wytheville and Pulaski, Va., and in Bluefields, Cooper, Simmons, Bramwell, Spicertown, Pocahontas, Keystone and Welch, in the Pocahontas coal fields of West Virginia. The company owns five water-power sites on the New River in Carroll, Grayson and Pulaski counties in Virginia, and controls two reservoir sites and an additional water-power site, all of the lands, water rights and utilities being free of all indebtedness other than the first mortgage bonds of the company. Work is now advancing rapidly on the development of two of these water-powers. One of them, known as Development No. 2, is to have a capacity of 20,000 hp at a net head of 49 ft., and the second, known as Development No. 4, is to have a capacity of 9000 hp at a net head of 34 ft. Contracts have been placed with the I. P. Morris Company, of Philadelphia, for seven 3000-kw (34-ft. head) waterwheels, with the General Electric Company for the corresponding generators and switchboards, and with the Westinghouse Electric & Manufacturing Company for transformers. Energy will be generated at 11,000 volts and transmitted at 80,000 volts. Owing to the abundance of timber in the section and to the rugged nature of the country, wooden poles will be used instead of steel towers. Contracts for the conductors have been awarded to the Aluminum Company of America. Substations are being located at Roanoke, Pulaski, Wytheville, Bluefields and Switchback. A contract has been closed with the Pocahontas Consolidated Collieries for all of their electrical requirements for a term of twenty years, and with the Zenith Coal & Coke Company for a term of three years. By developing the three remaining powers and providing suitable steam reserve, an additional 53,200 hp at 40 per cent load factor can be obtained. It is estimated that construction work will be completed by Oct. 1, 1912. A statement of earnings June 1, 1913, it is believed, will show gross earnings of $958,300, operating expenses of $289,000, and net earnings of $669,300; charges and preferred dividends of $425,100, leaving a surplus applicable to common stock of $244,200, or more than 4 per cent on the total issue of $6,000,000 par value of common stock. The management of the company and the general engineering is under direction of H. M. Byllesby, of Chicago, with whom Messrs. Viele, Blackwell & Buck, of New York, are associated in charge of the hydraulic development, power houses and high-tension distribution.

Georgia Railway & Power Company.—It is learned that the Georgia Railway & Power Company, which was recently incorporated with a capital of $27,000,000 as mentioned in the issue of Sept. 23, has contracted to purchase the property of the Atlanta Water & Electric Power Company, and will lease the property of the Georgia Railway & Electric Company. While announcement has not been made of the terms of the leases, J. J. Spalding, of Atlanta, one of the incorporators, gives an outline of their scope and of the purposes of the company in the following statement: "The Georgia Railway & Power Company has in mind to acquire the water-power properties of the Georgia Power Company, the Atlanta Water & Electric Power Company, and to acquire by lease the Georgia Railway & Electric Company, and especially to construct and operate in connection with the development of these water-powers a system of interurban electric railways. By leasing the Georgia Railway & Electric Company the new company will acquire the supplemental steam plants situated in Atlanta, which will enable it to double the capacity of the water-power development by supplementing it in dry weather, and also enable the new company to protect all of the towns and cities which it reaches with lines, in case of accident or emergency. All of the money furnished is coming from Canadian and English sources. The new company will be organized under Georgia laws and all of its properties will be subject to taxation in Georgia. The lease of the Georgia Railway & Electric Company will guarantee its present dividend, payable quarterly, and also all of its indebtedness, liabilities and obligations."

Large Westinghouse Orders.—Among recent contracts received by the Westinghouse Electric & Manufacturing Company is one from the commission government of Tacoma, Wash., for the entire switchboard and auxiliary apparatus for the power house, substation and transmission line of the 27,000-hp hydroelectric plant the city is erecting. About six tons of copper alone will be used in the construction of the switchboard. The amount involved in the contract, which also includes a large amount of details and supplies, is in the neighborhood of $85,000. Among other orders are the following: From the Susquehanna Railway, Light & Power Company for three quadruple-equipment, direct-current motors with control; from the Kokomo Public Utility Company, of Kokomo, Ind., for one quadruple-equipment, direct-current, interpole motor with control; from the Ft. Madison (Ia.) Street Railway Company for two double-equipment, direct-current motors with control; from the New York, New Haven & Hartford Railroad Company, of New Haven, Conn., for four single-phase railway motors; from the Cincinnati Traction Company, for forty-five double-equipment No. 318 motors with control.

Tenders for Toronto Tube Railway.—The Board of Control of the city of Toronto has prepared specifications for the proposed double-track subway railway line, known as the "Bay-Teraulay Street Tube," and are asking for tenders to be sent in by Nov. 1, in order to ascertain the probable cost of the undertaking, so that the tube question may be submitted to the vote of the ratepayers at the municipal election on Jan. 1 next. The proposed line is 3 miles long. James Forgie and E. Vipond Davies, of the firm of Jacobs & Davies, of New York, who made a special report on tube railways to the Toronto special committee last year, have stated that their firm does not propose to put in a tender for the Toronto tube line. Charles H. Rust is city engineer.

British Electrical Manufacturers' Association.—The National Electrical Manufacturers' Association, of Great Britain, has been reorganized and is now named the British Electrical Manufacturers and Allied Trades' Association. A well-paid secretariat has been established, which will carry out a program for the promotion of due consideration and discussion of all questions affecting the electrical manufacturing industry. The body will, in general, watch over and protect the interests of all engaged in the industry, look out for legislative matters and, by means of representatives throughout the world, supply information relating to possible orders, etc. W. H. Dunlop, sales manager of the British Westinghouse Company, has been appointed to the post of secretary.

Commonwealth Edison May Change Fiscal Year.—With a view to conforming with the requirements of the government calling for a complete report of the financial conditions and earnings of corporations in connection with the tax law, the management of the Commonwealth Edison Company is considering a change in the date of the fiscal year, to end Dec. 31, instead of Sept. 30, as at present. This matter will probably be considered at a directors' meeting Oct. 17. In case this change is made, the directors will probably make a change in the date of the annual meeting of stockholders to some time in February, instead of the last Monday in November, as is now the case.

Auglaize Power Company.—Rapid progress is being made on the 6000-kw hydroelectric plant of the Auglaize Power Company on the Auglaize River, near Defiance, Ohio, and R. R. Livingston, of 2 Rector Street, New York City, who designed the plant, says that it will be in operation by February, 1912. The company was incorporated July 1, 1911, and plans to supply energy in Lima, Defiance and Toledo, Ohio. An initial equipment of five 1000-kw, 2300-volt water-wheels and generators, with governors, has been ordered from the Allis-Chalmers Company. Switchboards and transformers for the 60,000-volt transmission line have been ordered from the General Electric Company.

New Platinum Prices.—A new record for platinum prices was made Oct. 3 when they were quoted in Maiden Lane, New York, at $47.50 an ounce for hard platinum and $45 an ounce for soft platinum. These figures represent an advance of $5 an ounce since the first of the year, and still higher prices are expected. The price in 1905 was $18.50 an ounce, which increased rapidly in 1906, reaching $38 an ounce for soft platinum and $40 for hard platinum in December. A decline to approximately half these prices took place in February, 1907, continuing until August, 1908, when an upward movement was made.

General Electric Orders.—The Charleston (S. C.) Mining & Manufacturing Company has placed an order with the General Electric Company for a 1250-kva, 2300-volt, three-phase horizontal turbine to operate at 3600 r.p.m., for use in their plant at Fort Meade, Fla. The company has had a 500-kw General Electric steam turbine in operation for nearly six years. The Anaconda Copper Company, of Butte, Mont., has placed an order with the General Electric Company for thirteen locomotives, which will be used for increasing its ore-handling facilities.

Meetings of Maryland Public Utility Companies.—At the annual meeting of the Consolidated Gas, Electric Lght & Power Company, in Baltimore, Oct. 2, Van Lear Black, first vice-president of the Fidelity Trust Company, was elected a director, replacing S. Reading Betron, resigned. Other business was of routine nature. Retiring directors of the Maryland Electric Railway Company were re-elected at the annual meeting of the stockholders on Oct. 2. Old officers of the company were also re-elected.

Hoskins Manufacturing Company Takes Over International Electric Meter Company.—Under date of Oct. 2 the Hoskins Manufacturing Company, of 453 Lawton Avenue, Detroit, Mich., announces that it has taken over the business and property of the International Electric Meter Company of Chicago. The Hoskins company assumes all liabilities of the International company. The business of the latter will be removed to Detroit and conducted by the Hoskins company.

Virginia Railway & Power Company.—According to the New York office of the Virginia Railway & Power Company, an expenditure of $600,000 will be made shortly for additions to the Richmond power station of the company and for various improvements to the traction properties. The company has declared an initial semi-annual dividend of 1 per cent on its common stock, payable Oct. 20 to stockholders of record as of Oct. 7.

Growth of Traction Systems in Spokane.—Although street-railway building in Spokane, Wash., began as recently as 1902, the total investment now represented in the city by the systems of the Washington Water Power Company and the Spokane Traction Company is close to $42,000,000, and the city is said to have the third greatest system of electric railways in the United States.

Tri-City Railway & Light Equipment.—J. G. White & Company have purchased four 300-kw, 1200-volt motor-generator sets, one 2000-kw, five 1000-kw and four 200-kw transformers, for distribution at the Davenport, Rock Island and Moline stations of the Tri-City Railway & Light Company.

Aluminum Notes and Prices.—The aluminum market is steady, and ingots for remelting are held at 20@22 cents spot No. 1, the base for large ingots. Rods and wire are quoted at 31 cents and sheets at 33 cents, the prices being those of Oct. 3.

Financial.

The Week in Wall Street.

ABSENCE of disturbing influences has caused a mild recovery in the stock market, and while trading is light in volume a better tone is noticeable. Last week closed with Steel shares on an upward trend, and under this lead many stocks made small gains on Friday and Saturday. Further gains were made on Monday, but there was a marked decrease in the volume of transactions. United States Steel advanced to 62⅝ early in the day, but declined in the later trading and closed at opening prices. The most conspicuous gain of the day was a 3½-point rise in United States Rubber common, other issues on the list showing only fractional advances. The final condition report of the Department of Agriculture indicating a record cotton yield was the chief topic in financial and industrial quarters during the day. Tuesday's market was very dull, and business was light, accompanied by wavering prices, the apparent cause of which was the halting attitude shown on foreign exchanges resulting from European controversies. Decline in money rates on foreign exchange was the most important feature of the day. Lower rates were quoted in Berlin, Vienna and London, indicating relief in the money strain. A further sign of improvement in financial affairs is found in the fact that bond transactions in September were the heaviest since January, total sales amounting to $62,625,000, which is an increase of $15,147,500 over the previous month, and slightly in excess of September, 1910. Activity in American Tobacco issues was a leading cause of the increase in bond transactions during the month. The Street is showing very little interest in the Turkish situation. Rates in the money market October 3 were: Call, 2@2¼ per cent; ninety days, 3¾@4 per cent. The quotations in the tables are those at the close October 3.

NEW YORK.

	Sept. 26.	Oct. 3.	Shares Sold.		Sept. 26.	Oct. 3.	Shares Sold.
All. Ch.....	6	6*	400	Int. Met., pf.	41	42	5,100
All. Ch., pf..	16½*	16½*	———	Mackay Cos.	83*	82¾*	100
Amal. Cop...	47⅝	49⅜	238,600	Mackay, C.,pf.	72½	72½*	———
Am. D. T....	20½	33⅛*	———	Man. Elev...	131¼*	132*	250
Am. Loco....	33⅛	35½*	2,000	Met. St. Ry..	15*	15*	———
Am. Loco., pf.	104½*	105⅛	———	N.Y.&N.J.Tel.	139½*	139½	———
Am. Tel. & C.	80½*	80½*	———	Steel, com...	56⅞	60⅝	2,576,500
Am. T. & T..	134½	133⅜	18,250	Steel, pfd....	107¼	109¼	66,133
B. R. T.....	73⅜	73¾	12,360	W. U. T....	77¼	77⅜	5,190
Gen. Elec....	144	148½	11,900	West'h, com.	61	62¾*	3,000
Int. Met.....	13¾	15	6,300	West'h, pf...	110½*	110½*	———

PHILADELPHIA.

	Sept. 26.	Oct. 3.		Sept. 26.	Oct. 3.
Am. Rys.....	44	44	Phila. R. T.....	21	21⅞
El. Co. of A.....	11⅝*	11⅝	Phila. Elec.....	16¼	16¾
Elec. St. Bt'y.....	50	51	Phila. Trac.....	82*	82¾
Elec. St. Bt'y, pf....	30*	30*	Union Trac.....	48½	49¾

CHICAGO.

	Sept. 26.	Oct. 3.		Sept. 26.	Oct. 3.
Chi. City Ry.....	186*	186*	Com. Edison.....	134	134
Chi. Elev. Rys.....	24*	24*	Chi. Subway.....	1⅝	2¼
Chi. Elev. Rys., pf..	89½*	89½*	Chi. Telephone.....	122*	120
Chi. Rs., Ser. 1....	92*	92*	Nat'l Car.....	101*	101*
Chi. Rs., Ser. 2....	27*	27*	Nat'l Car, pf.....	118½*	118½*

BOSTON.

	Sept. 26.	Oct. 3.		Sept. 26.	Oct. 3.
Am. T. & T.....	134½	133⅝	Mex. Tel.....	6*	3*
Cum. Tel.....	150½	149⅞*	Mex. Tel., pf.....	6*	6*
Edison	285	280*	N. E. Tel.....	143¼	143¼*
Gen. Elec.....	144	148	W. T. & T.....	15	18*
Mass E. Ry.....	17*	19	W. T. & T., pf....	95	95*
Mass. E. Ry., pf....	87½*	89¼			

*Last price quoted.
Shares sold for the week, Sept. 25 to Sept. 30.

Financial Notes.

Stone & Webster Companies.—Securities of several companies under Stone & Webster management are being offered at attractive prices. Among these offerings is the 6 per cent preferred stock of the El Paso Electric Company, which owns the securities of local companies doing the entire electric railway and practically all the electric lighting and power business in El Paso, Tex., the electric lighting and power business in Juarez, Mexico, and operates an electric railway between El Paso and Juarez. Gross earnings of the company for the twelve months ended July 31, 1911, were $667,937, and net earnings after deduction of all charges were $182,154, representing over three times the amount required to pay 6 per cent dividends on the $1,000,000 preferred stock. Dividends at the rate of 5 per cent are now being paid on $1,000,000 common stock. Another offering is the 6 per cent cumulative preferred stock of the Pensacola Electric Company, which does the entire electric-railway business in Pensacola and owns the securities of the Escambia County Electric Light & Power Company, which furnishes all the electric lighting and power service in the city. The property has been under Stone & Webster management since 1906. Its gross earnings in the twelve months ended July 31, 1911, were $285,249, and the net earnings after deduction of all charges were $51,612, or over two and one-half times the $18,000 dividends on $300,000 preferred stock. The Railway & Light Securities Company's collateral trust 5 per cent bonds, third series, due 1939, are also available. The company was organized in 1904 for the purpose of holding for income or for sale the securities of transportation, illuminating, power or other public service corporations. It now holds securities in thirty independent companies, seventeen of which are under Stone & Webster management. The income of the company after deduction of all expenses shows over two and one-half the 5 per cent interest requirements on the three series of collateral trust bonds aggregating $1,394,000. First consolidated mortgage 5 per cent gold bonds of the Jacksonville Traction Company are included in the list. This company has acquired all the property and assumed the obligations of the Jacksonville Electric Company, and now does the entire electric railway business in Jacksonville, Fla. Its earnings in the twelve months ended July 31, 1911, were over twice the amount required to pay 5 per cent interest on all bonds outstanding.

Electric Properties in Oregon.—Annual reports filed with the Oregon State Railroad Commission give the records of the following companies: Portland Railway, Light & Power Company: Electric railway—total operating revenue, $3,871,032; total operating expenses, $2,015,788; net operating revenue, $1,855,244; net income, deducting all expenses, $1,656,257; passenger revenue, $3,466,708; freight revenue, $273,095. Chief items of miscellaneous revenue: Light and power, $1,415,261; Vancouver ferry, $33,624; locks and canals, $17,454; total funded debt, $4,346,600; taxes accrued, and yet due, $119,954; total cost of property to June 30, 1911, $29,860,462; total mileage of track in operation, 262.7; dividends of 2½ per cent were declared on $5,000,000 preferred stock and dividends of 2 per cent on $35,000,000 common stock. Oregon Electric Railway Company: Total operating revenue, $616,079.79; total operating expenses, $323,512.28; net income, deducting all expenses, $167,404.10; passenger revenue, $485,142.44; freight revenue, $100,693.37; total mileage of track in operation, 71.28. Astoria & Columbia River Railway: Total operating revenue, $603,847.77; total operating expenses, $339,994.84; net income, deducting all expenses, $146,335.15; passenger revenue, $371,459.63; freight revenue, $122,420.70; total mileage of track in operation, 79.60.

American Traction & Power Company.—The board of directors of the American Traction & Power Company, which was recently incorporated in Delaware with a capitalization of $500,000, as mentioned in the issue of Sept. 23, has completed the organization of the company by election of officers. The company has begun the consideration of plans for extensive traction developments in the South, in accordance with the purposes specified in its incorporation papers, which include the organization, financing, operation and construction of steam and electric railroads and power companies in Southern States. The American Traction & Power Company is a holding corporation for the Yazoo Valley (Miss.) Electric Railroad, Light & Power Company and the Kentucky Southwestern Railway, Light & Power Company.

September Incorporations.—During September papers filed in the Eastern States for companies with an authorized capital of $1,000,000 or over, including increases in capital, aggregated $77,004,000, which is a decrease of $10,346,000 from August figures, and an increase of $18,904,000 over totals on September, 1910. Papers filed by other companies with a capital of $100,000 and over, including states other than those in the East, made a total of all incorporations for the month of $156,912,000, which compares with $144,509,000 in August and with $114,593,000 in September, 1910.

Salt Lake & Ogden Railway Bonds.—Banking houses are placing $75,000 first mortgage, 5 per cent gold bonds of the Salt Lake & Ogden Railway Company, which are dated February, 1909, and due Feb. 1, 1934, but are callable at 105 and interest after Feb. 1, 1914. The company operates a high-speed interurban electric railway, 35½ miles in length, on private right of way between Salt Lake City and Ogden, serving a population of 130,000. Its capital stock, authorized and issued, is $1,500,000 in addition to which $2,000,000 first-mortgage bonds are authorized, of which $1,075,000 has been issued, and $925,000 is reserved. The larger part of the proceeds of the $1,000,000 bonds first issued was devoted to improvements and the completion and electrification of the line. The proceeds of these $75,000 bonds will be used to pay part of the cost of track extensions. In addition to the bonds the stockholders' investment is over $900,000, not allowing for the franchises, all of which are satisfactory and do not expire until 1955. The $925,000 of bonds still in escrow can be issued only for 75 per cent of the cost of extensions and additions, provided net earnings are twice the interest charge. Gross earnings of the company for the year ended July 31, 1911, were $320,963, and net earnings, after deduction of taxes, were $126,745.

Earnings of Mexican Telegraph Companies.—Effects of the political disorders in Mexico in the past few months are reflected in the decreased earnings of the Mexican and Central & South American Telegraph companies. Estimated earnings of the Central & South American Telegraph Company for the quarter ending Sept. 30 indicate a decrease of $33,000 in gross earnings, as compared with receipts during the corresponding quarter in 1910, with a loss of $20,500 in net and of $22,650 in surplus available for dividends. Corresponding losses are expected in the returns of the Mexican Telegraph Company, and it is believed that gross earnings in the September quarter this year will be about $12,500, which would represent total gross receipts of $175,000, as compared with $187,000 last year. Net earnings are expected to show an equal decline, and a falling off of about $10,500 is thought probable in the surplus available for dividends. These declines are regarded as of temporary nature only, for the resources of the country are abundant and resumption of normal conditions is advancing rapidly.

Dayton Power & Light Company.—Final organization of the new consolidated company in Dayton, Ohio, known as the Dayton Power & Light Company, whose prospective formation was described in these columns June 22, was effected at a meeting Oct. 2, at which the following directors and officers were elected and qualified for the coming year: Directors—Messrs. F. M. Tait, E. P. Mathews, H. E. Talbott, F. T. Huffman, J P Breen, Maurice Costello, A. J. Conover, A. M. Young, M. J. Warner, William Stroop, L. K. Funkhauser, H. C. Kiefaber and Charles Wurchet. Officers—F. M. Tait, president and general manager; E. P. Matthews, vice-president; C. L. Campbell, treasurer; L. K. Funkhauser, secretary; M. J. Warner, assistant secretary and assistant treasurer; O. H. Hutchings, superintendent; B. H. Gardner, sales manager. The Dayton Power & Light Company has declared a quarterly dividend of 1½ per cent on the preferred stock of the company, payable Oct. 15 to stockholders of record as of Sept. 30. The large increase in capacity which the company is installing will shortly be placed in operation.

Republic Railway & Light Company.—Gain in gross earnings of the Republic Railway & Light Company in the seven months ended July 31 was $56,300 over the returns in the corresponding period last year, and an increase of $33,100 was shown in net earnings in this time. August and September returns are said to be much larger than in the corresponding months last year. Present earnings indicate that the company will show over 2¾ per cent on its common stock this year, about 4 per cent in 1912, and close to 5¼ per cent in 1913. The plans of the company call for large expenditures in the next few years for improvements and betterments to the properties. About $300,000 is to be spent for this purpose this year as previously mentioned in these columns, and an equal amount will be spent next year. This will be increased to $500,000 in 1913, to $700,000 in the year following, and to almost $1,000,000 in 1915. Prospective business and proper maintenance in the next five years, it is believed, will justify these expenditures.

Winnipeg Electric Railway Shows Improvement.—Total net revenues of the Winnipeg Electric Railway Company for the seven months ended July 31 were $1,096,226, as compared with $897,135 in the same period last year, which is an improvement of about 22 per cent. Net earnings in July were $170,600, as compared with $132,260 in July, 1910, and were larger than those of any month this year since January, when the total was $157,795. These figures point out the likelihood of net returns for the year approaching $2,000,000, which fully justifies the recent increase of 2 per cent in the dividend rate, which now stands at 12 per cent per annum.

Boston Elevated $5,000,000 Bond Issue Authorized.—Stockholders of the Boston Elevated Company, at a special meeting Sept. 29, authorized the directors of the company to issue negotiable bonds to the amount of $5,000,000. The proceeds will be used to provide means for construction and equipment and to pay the floating debt of the company. Of the 104,255 represented at the meeting, only thirteen shares were voted against the issue.

Philadelphia Rapid Transit Company.—The August report of the Philadelphia Rapid Transit Company shows total gross receipts of $1,794,989. Net earnings amounted to $668,772, and fixed charges to $736,683, leaving a deficit of $67,910. The deficit for the two months ended August 31, 1911, was $93,151. Old officers of the company were re-elected at the recent directors' meeting.

Tri-State Telegraph & Telephone Company Sold.—The Southwestern Telegraph & Telephone Company has purchased the Tri-State Telegraph & Telephone Company and will shortly assume charge of the exchanges at Osceola, Wilson, Blytheville and at several other places in Arkansas now operated by the company.

DIVIDENDS.

Associated Gas & Electric Company, quarterly, preferred, 1¾ per cent, payable Oct. 16.

Bell Telephone Company, of Pennsylvania, quarterly, 1½ per cent, payable Oct. 16.

Boston Suburban Electric Company, quarterly, preferred, $1 per share, payable Oct. 16.

Fort Smith Light & Traction Company, quarterly, preferred, 1¾ per cent, payable Oct. 16.

Mexican Power Company, semi-annual, preferred, 3½ per cent, payable Nov. 1; quarterly, common, 1 per cent, payable Oct. 16.

Nebraska Telephone Company, $1.50 per share, payable Oct. 10.

Northern States Power Company, quarterly, preferred, 1¾ per cent, payable Oct. 16.

Ottumwa Railway vs. Light Co., quarterly, preferred, 1¾ per cent, payable Oct. 16.

San Diego Consolidated Gas & Electric Company, quarterly, preferred, 1¾ per cent, payable Oct. 16.

Virginia Railway & Power Company, semi-annual, common, 1 per cent, payable Oct. 20.

Western States Gas & Electric Company, quarterly, preferred, 1¾ per cent, payable Oct. 16.

REPORTS OF EARNINGS.

ATLANTIC CITY ELECTRIC COMPANY.

Period.		Gross. Earnings.	Operating. Expenses.	Net. Earnings.	Fixed Charges.	Net Surplus.
August,	1911	$50,061	$14,544	$34,517	$7,546	$26,971
August,	1910	46,146	16,187	29,959	4,854	25,105

CANTON ELECTRIC COMPANY.

August,	1911	$22,068	$12,100	$9,968	$3,139	$6,829
August,	1910	19,482	10,019	9,463	3,276	6,187

CUMBERLAND TELEPHONE & TELEGRAPH COMPANY.

August,	1911	$603,239	$360,401	$242,838	$50,637	$192,201
August,	1910	571,856	322,490	249,365	49,603	199,762

MUNCIE ELECTRIC LIGHT COMPANY.

August,	1911	$21,559	$11,851	$9,708	$6,429	$3,279
August,	1910	18,686	11,019	7,667	4,534	3,143

PHILADELPHIA COMPANY.

August,	1911	$1,493,155	$1,038,372	$793,612	$594,004	$199,607
August,	1910	1,559,234	979,773	880,261	580,501	299,760

ROCKFORD ELECTRIC COMPANY.

August,	1911	$26,649	$14,797	$11,852	$6,764	$4,818
August,	1910	25,762	18,201	7,561	6,065	1,496

SCRANTON ELECTRIC COMPANY.

August,	1911	$54,499	$23.400	$31,099	$12,574	$18,525
August,	1910	50,353	22,056	28,297	10,866	17,431

General News

Construction News.

PIEDMONT, ALA.—It is reported that an election will be held Oct. 18 to vote on the proposition to issue $25,000 in bonds, the proceeds to be used for the installation of an electric-light plant and extensions to the water-works system.

TUSCALOOSA, ALA.—Application has been made to the City Commissioners by F. G. Blair and H. B. Foster for a franchise to build and operate an electric power plant and street railway system and also for a natural and artificial gas plant in Tuscaloosa.

PRESCOTT, ARIZ.—The Arizona Power Company is planning to build a transmision line from Poland Junction to Crown King, via Mayer and Blue Bell. R. S. Mason is chief engineer.

CLARKSVILLE, ARK.—It is reported that surveys are being made by Winters & Dove, of Fort Smith, Ark., in connection with the installation of a municipal electric-light plant.

LITTLE ROCK, ARK.—The Southwestern Telegraph & Telephone Company has purchased the plant and holdings of the Tri-State Telegraph & Telephone Company and will take over the exchanges at Oscela, Blytheville, Manila, Wilson and Luxora.

MURFREESBORO, ARK.—Application has been made to the Council by E. C. Ellsworth, of Murfreesboro, Ark., for a franchise to install electric-light plant, water-works and ice plant in this town.

ANAHEIM, CAL.—The Board of Trustees has awarded the contract for the erection of an addition to the municipal power plant to W. W. Scott.

AUBURN, CAL.—The Placer Electric Company is reported to have purchased a half interest in the Rawhide mine at Towle and the Home Picket mine at Last Chance, and is planning to erect a large hydroelectric power plant on the American River, near Auburn.

CORONA, CAL.—The Sierra Light & Power Company is reported to be contemplating the reconstruction and improvements to its power plant and distributing system in Corona.

COTTONWOOD, CAL.—Plans are being considered by the Sacramento Valley Power Company for the erection of a transmission line from Cottonwood to Dry Creek, to supply power for gold dredging work.

CROCKETT, CAL.—Work will soon begin on the erection of a new cable from the south tower in Crockett to the north tower of the Pacific Gas & Electric Company on the Solano shore to replace the old cable which was burned out three years ago.

EUREKA, CAL.—The Board of Supervisors has granted the Western States Gas & Electric Company a franchise to erect and maintain transmission lines in District No. 3.

FRESNO, CAL.—A complete telephone system is to be established along the route of the Guaranty Pipe Line Company from the Midway oil fields to Ventura, bids for construction of which are now being received.

FRESNO, CAL.—Bids will be received by the Board of County Supervisors until Nov. 7 for sale of a franchise to erect transmission and distributing lines from the San Joaquin River to different sections of the county for a period of fifty years, for which application was made by the Pacific Light & Power Corporation, of Los Angeles, Cal.

FULLERTON, CAL.—The Board of City Trustees has entered into a three-year contract with the Southern California Edison Company for street lighting. The contract calls for 500-watt, 250-watt and 50-watt tungsten lamps with center-type suspension.

GREENVILLE, CAL.—The Seneca Mining & Milling Company is reported to be contemplating the erection of a hydroelectric power plant on its power site on the Feather River.

GREENVILLE, CAL.—Preparations are being made by the Indian Valley Electric Light & Power Company to extend its transmission line from Greenville to Crescent Mills and Taylorsville. The company has purchased water rights along the north fork of the Feather River amounting to about 50,000 in. of water and is planning to erect a plant at that point in the spring and also another transmission line from there to Indian Valley to supply electricity for lamps and motors in that vicinity.

GRIDLEY, CAL.—The Gridley Produce & Canning Company is contemplating the installation of an electric-light and power plant to supply electricity to operate its works.

GRIMES, CAL.—The Northern California Power Company is contemplating extending its transmission lines to Grimes.

KNIGHTS LANDING, CAL.—The Pacific Gas & Electric Company is planning to erect a transmission line from Knights Landing to Howell Point for supplying power through special contract.

LEWISTON, CAL.—The Trinity Dredging Company has been granted a franchise to erect transmission lines in this district for a consideration of $144.

LOS ANGELES, CAL.—The Board of County Supervisors has awarded the contract for the installation of engine-driven generator units in the Hall of Records to the C. C. Moore Company, for $21,611.

LOS ANGELES, CAL.—The Southern California Edison Company is reported to have engaged Charles McBride, civil engineer, to investigate possible power sites in the Sierra Nevada Mountains, San Joaquin Valley district.

LOS ANGELES, CAL.—The Board of County Supervisors is advertising for sale an electric railway franchise from San Fernando to the Junction of Fifth and Paicoma Avenues, in the Paicoma section, for a period of forty years, bids for which will be received until Oct. 30.

LOS ANGELES, CAL.—The Board of Public Service Commissioners has adopted a resolution favoring the submission to the voters of the proposition to issue $5,500,000 in bonds to provide for a complete distributing system for all municipal and commercial light and power business within the city limits.

LOS ANGELES, CAL.—Parkinson & Bergstrom, architects, Security Building, Los Angeles, Cal., have awarded the contract for furnishing and installing electric-lighting fixtures in the eleven-story Chester Building, at Spring and Fifth Streets, to the Meyberg Company, West Sixth Street, Los Angeles, Cal., for $5,650.

OAKLAND, CAL.—Work will begin at once by the Oakland Traction Company on laying track for its Hopkins Street railway, about 3 miles in length. Orders have been issued for double-tracking of San Pablo Avenue from West Berkeley through Albany to the intercounty line. Work will also begin immediately on the East Sixteenth line in Oakland.

OROVILLE, CAL.—It is reported that the Oro Water, Light & Power Company has purchased a large interest in the Butte & Tehama Power Company and the Sierra Irrigation Company.

REDLANDS, CAL.—K. C. Wells and the University Realty Company are interested in a project to build an electric railway on Colton Avenue from the University of Redlands to a junction with the Pacific Electric Railway at Orange Street.

RIVERSIDE, CAL.—The Southern California Edison Company, it is reported, is contemplating the construction of a substation on the property recently acquired in Riverside.

SANTEE, CAL.—Work has commenced on the construction of the proposed electric power-plant for James Ballantyne, near El Cajon.

SAN BERNARDINO, CAL.—The City Council has granted Fred B. Mechling a franchise to construct and operate an electric system to supply electricity for lamps, heat and motors in San Bernardino.

SAN FRANCISCO, CAL.—Plans and specifications are being prepared for the power house and equipment of the Geary Street Municipal Railway by A. M. Hunt, of San Francisco, Cal., consulting engineer.

SAN FRANCISCO, CAL.—The contract for installing a complete electric-lighting system at Ft. Miley, Cal., has been awarded to the McFell Electric Company, 201 Sansome Street, San Francisco, Cal., at $17,210.

SAN FRANCISCO, CAL.—The Pacific Fire Extinguisher Company, of San Francisco, Cal., has secured the contract for switchboards, switches, conduit work, etc., in the new building of the Bankers' Investment Company, on Geary Street, at $8,400.

SAN FRANCISCO, CAL.—The Board of Supervisors has granted Paul B. Fay permission to build a double-track railway on Bryant Street to connect existing tracks on Army Street and Twenty-sixth Street. The line will be operated by the United Railroads Company.

SAN FRANCISCO, CAL.—It is reported that the United Properties Company has awarded contracts amounting to $2,000,000 for electrical equipment. What the order consists of has not been announced, but it is believed to be the first move toward important extensions of the Key Route system.

SAN FRANCISCO, CAL.—Bids will be received by the Board of Public Works, David Hewes Building, Market Street, San Francisco, Cal., until Nov. 1 for forty-three double-end, pay-as-you-enter, closed steel motor cars, with four extra trucks, complete with axles, wheels and motors, for the Geary Street Municipal Street Railway. This road will not be constructed immediately, as planned, owing to the temporary injunction prohibiting the building of the line on Point Lobos Avenue.

SUTTER CREEK, CAL.—It is reported that new electrical pumping machinery will be installed in the Poundstone mine.

TERRA BELLA, CAL.—The Ducor-California Hot Springs Telephone Company, a co-operative organization, has been formed to construct and operate a telephone system in this district. L. S. Wingrove is president.

UPLAND, CAL.—The Ontario & San Antonio Heights Electric Railway is reported to be contemplating extending its railway from Upland to Cucamonga. This road is operated by the Pacific Light & Power Company, of Los Angeles.

VENICE, CAL.—The Abbot Kenney Company, it is reported, is planning to install a large electric plant in Venice, at a cost of about $100,000. It is understood that orders have already been placed for machinery.

WOODLAND, CAL.—The Sacramento Valley Westside Electric Railway Company has instructed its attorney to prepare application for franchises in Yolo, Colusa, Glenn and Tehama Counties. Charles L. Donohoe, of Willows, is president of the railway.

MONTROSE, COL.—The Montrose Electric Light & Power Company has applied to the Council for a twenty-year franchise. If granted a franchise the company guarantees to expend $100,000 for extensions and improvements to its plants.

EAST HAMPTON, CONN.—Extensive improvements are contemplated to the electric plant of the East Haddam Electric Light Company, located at Leesville. It is proposed to extend the service to East Haddam.

HARTFORD, CONN.—The Senate has passed the new bill for a charter for the Connecticut River Power Company which contains suggestions made by Governor Baldwin and is acceptable to him.

NEW BRITAIN, CONN.—Three new boilers are being installed in the power plant of Landers, Frary & Clark Company, of New Britain, Conn. The output of the plant is being increased to provide power for the new factory building now being erected on Center Street.

NEW HAVEN, CONN.—The New York, New Haven & Hartford Railroad Company has awarded the contract for equipping its branch road from Branford to New Haven, 12 miles in length, for electrical operation to Joseph A. Lyons, 237 Lincoln Street, New Haven, Conn.

WASHINGTON, D. C.—Sealed proposals will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until Oct. 12, under proposal No. 550, for furnishing 15 miles of galvanized wire, steel No. 6; 240 miles of galvanized wire, steel No. 14, and 18,000 ft. of wire, phosphor bronze, seven-strand, No. 14. Captain R. J. Burt is disbursing officer, Signal Corps, United States Army.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 24 for furnishing at the navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 3983—four ash-hoisting engines. Schedule 3984—two turbo-generator sets. Schedule 3989—1100 lb. bar brass. Newport, R. I., Schedule 3989—10,000 lb. brass tubing. Applications for proposals should designate the schedule desired by number.

JACKSONVILLE, FLA.—At an election held Sept. 26 bonds to the amount of $500,000 were authorized for municipal improvements, of which $35,000 will be used for improvements to the electric-light plant and water-works system.

AMERICUS, GA.—Steps have been taken by local capitalists toward the organization of a company for the purpose of establishing an electric-light system and gas plant in Americus and surrounding territory. The proposed company will be capitalized at $50,000. Frank Lanier and Frank Sheffield are interested in the project.

ATLANTA, GA.—It is reported that plans have been completed for consolidating all the hydroelectric power plants in the Piedmont region. The properties will be taken over by the Georgia Railway & Power Company, recently incorporated with a capital stock of $27,000,000.

SAVANNAH, GA.—Extensive improvements will be made to the Indian Street station of the Savannah Electric Company, work on which has already begun. New equipment will be installed, including two boilers of 400 hp each, one 500-kw generator, 75-kw generator, exciter, etc. The cost of the work is estimated at $100,000.

CISSNA PARK, ILL.—The Iroquois Telephone Company is contemplating extending its system to Cissna Park. New cables will be erected and other improvements made.

DIXON, ILL.—The installation of an ornamental street-lighting system in Dixon is reported to be under consideration. It is proposed to erect single lamp-posts, ten to the block, for seven blocks.

FREEPORT, ILL.—The Freeport-Madison Electric Railway Company entered into a contract with Hugh G. Palmer, of Yorkville, for the construction and financing of the first section of its railway from Freeport to Cedarville, a distance of 16 miles. The railway will eventually extend from Freeport, Ill., to Madison, Wis. W. T. Raleigh, of Freeport, Ill., is promoter.

HAVANA, ILL.—The Illinois Valley Gas & Electric Company, which recently purchased the property of the Havana Electric Company, will make temporary repairs to the plant. The company, it is reported, will build a new electric plant in Havana next spring.

HILLSBORO, ILL.—A meeting of the stockholders of the Sangamon Valley Railroad Company will be held Nov. 29 to vote on the proposition to increase the capital stock of the company to $100,000. the proceeds to be used for extensions and improvements to the property, including the construction of new bridge, purchase of new cars, power machinery, extension of the railway north of Hillsboro and to pay its share of the paving in Hillsboro. John E. Melick, of Springfield, Ill., is president of the company.

NORTH ILION, ILL.—A proposition whereby the Ilion municipal electric-light plant will supply electricity for lamps in North Ilion, to be paid for by the town of Herkimer, is under consideration by the officials of Herkimer. North Ilion is part of the town of Herkimer, but is nearer to Ilion than Herkimer. If the Herkimer board approves the contract, electricity will be transmitted to North Ilion at once.

ORANGEVILLE, ILL.—The Village Board has granted C. W. Bennett, of Black Earth, Wis., a franchise to operate an electric-light plant in Orangeville for a period of fifteen years. The board also awarded a contract for street lighting under the terms of which Mr. Bennett is to furnish twenty 100-cp tungsten street lamps at $500 per year. The village reserves the privilege of purchasing the plant at the end of ten and fifteen years by giving six months' notice. If the plant is not taken over by the municipality at the end of fifteen years the franchise will be extended another five years.

PANA, ILL.—The Pana Commercial Club has taken up the proposition of installing an ornamental street-lighting system in Pana.

SYCAMORE, ILL.—The City Council has awarded the contract for the installation of the new electric-lighting system to the DeKalb-Sycamore Electric Company for $2,750. The Council has also authorized all poles, wires and other overhead equipment, with the exception of the trolley and suspension wires of the interurban company, to be removed on State Street from Main to California Street.

WAUKEGAN, ILL.—The Illinois Tunnel Company, it is reported, is contemplating extending its telephone service to this city.

COLUMBUS, IND.—The merchants of this city have contributed $2,500 for the installation of ornamental cluster lamps in the business section of the city. The City Council has agreed to give $1,000 and maintain the lamps after they are installed.

HAMMOND, IND.—The Hammond Steel Barrel Company, recently incorporated with a capital stock of $100,000 is planning to build a new plant on the Calumet River, to cost about $50,000. The plant will be equipped for electric-motor drive. J. F. Lafave is president and N. C. Cunningham is secretary.

MICHIGAN CITY, IND.—The Board of Trustees of the Indiana State Prison has awarded the contract for the installation of a power plant and pumping plant for the State Prison, located in Michigan City, to the Ft. Wayne Electric Works, at $11,500. The equipment will include two 150-kw Ft. Wayne generators direct connected to Fleming-Harrisburg engines, switchboard and two Platt centrifugal pumps with Ft. Wayne motors. A. J. Hammond, of South Bend, Ind., is consulting engineer for the Board of Trustees.

MUNCIE, IND.—Ball Brothers, manufacturers of fruit jars, are erecting a zinc-plating factory near their fruit jar plant. The plant will be equipped for electrical operation throughout.

TERRE HAUTE, IND.—A 300-kw electric generator is being installed in the Deep Fourth Vein mine north of West Terre Haute. The work is being done under the supervision of Claude Erwin, electrical engineer.

BURLINGTON, IA.—Preparations are being made for extensive improvements and extensions to the power plant of the People's Gas & Electric Company, including the installation of a new engine and generator. It is understood that a number of manufacturing plants propose to utilize electricity to operate their factories. The company also operates the local street-railway system.

DELHI, IA.—A proposition has been submitted to the Town Council by W. R. Furman, of Delhi, Ia., who owns water rights at Troy Mills, offering to supply electricity in Walker at 1½ cents per kw-hour. Mr. Furman states that if the town of Walker or private capital will erect a transmission line from Walker to the Troy Mills water-power he will purchase a new waterwheel and generator. He estimates that the transmission line would cost from $500 to $700 per mile.

FT. DODGE, IA.—Preparations are being made by the Ft. Dodge, Des Moines & Southern Railway Company to enlarge its power station.

IOWA FALLS, IA.—At an election held recently the proposition to grant O. F. Peterson, of Des Moines, Ia., a franchise to build and operate an electric-light plant in Iowa Falls for a period of twenty-five years was carried.

MANCHESTER, IA.—A contract has been awarded for the installation of sixty-five electroliers, each carrying five lamps, on Franklin Avenue.

OSKALOOSA, IA.—The Des Moines River Power Company is reported to be contemplating the installation of a 10,000-hp power plant.

REDFIELD, IA.—At a special election held recently the proposition to issue bonds to the amount of $15,000, the proceeds to be used for the installation of an electric-light plant and water-works system, was carried.

VAN HORNE, IA.—It is reported that it is proposed to issue $10,000 in bonds for the construction of an electric-light plant to replace the one that was burned.

OSBORN, KAN.—Rollins & Westover, of Kansas City, Mo., consulting engineers, have been engaged to prepare plans and specifications for a municipal electric-light plant for Osborn, Kan.

SOUTH HAVEN, KAN.—We are informed that bonds to the amount of $7,000 have been voted for the installation of a municipal electric-light plant. As yet no engineer has been engaged. J. R. Britton is city clerk.

WATERVILLE, KAN.—The installation of a municipal electric-light plant in Waterville is under consideration, for which bonds have been issued.

LIVERMORE, KY.—The Smith Cooperage Company is reported to be contemplating the installation of a power plant.

NEWPORT, KY.—The Board of Aldermen has awarded a contract

to the Great Western Electric Company for placing the wires of the fire department underground.

VERSAILLES, KY.—The Kentucky Traction & Terminal Company is reported to have awarded a contract to Fred J. Rump, of Versailles, to construct a combined electric substation and passenger and freight depot. The electric equipment will include a 300-kw rotary converter. The main plant of the company is to be located at Lexington, Ky.

WHITEHALL, MD.—It is reported that preparations are being made by the Whitehall Manufacturing Company, which has recently acquired paper mills in Whitehall, practically to rebuild the plant. It is understood that contracts have been placed for the installation of an electric-light plant to supply electricity for lamps and motors for the mills and for lighting the buildings in the vicinity of the plant. F. M. Rudolph, it is said, will be superintendent.

AMHERST, MASS.—The plant and holdings of the Amherst Gas Company are reported to have been purchased by Cabot, Thompson & Eustis. A new set of directors have been elected.

BOSTON, MASS.—At a special meeting of the stockholders of the Boston Elevated Railroad Company, held Sept. 29, the directors were authorized to issue negotiable bonds to the amount of $5,000,000, to provide means for construction and equipment and to pay the floating debt of the company.

CHELMSFORD, MASS.—The Selectmen have awarded a contract to the Lowell Electric Light Corporation for lighting the streets of the town. The new contract will save the town about $1,100 per year in the territory at present lighted with oil, gas and electricity. About 12 miles of pole lines will be erected. It is expected to have the entire system installed in about three months.

EASTON, MASS.—The installation of an electric-lighting system in Easton is under consideration. The Edison Electric Illuminating Company of Brockton has offered to supply the service and furnish street lamps under a ten-year contract at the same rate as charged in Mansfield.

FALMOUTH, MASS.—The Buzzards Bay Electric Company has applied to the Selectmen for locations for its pole lines through West and North Falmouth. The company has not yet decided on the location of its permanent power station. Eugene Carpenter is treasurer of the company.

FRANKLIN, MASS.—The Union Electric Light Company has been granted a franchise to erect its transmission line in Wrentham to the Foxboro line. The company has also petitioned the Selectmen of Plainville for a franchise in that town.

GARDNER, MASS.—The Gardner Electric Light Company is extending its electric service to Barre, Templeton and Belchertown. The company is supplying lighting service on a flat-rate basis with excess indicator.

PITTSFIELD, MASS.—The Berkshire Street Railway Company has applied to the State Railroad Commission for permission to increase its capital stock from $1,948,100 to $6,848,100, the proceeds to be used for extensions, improvements, refunding debt, etc.

WALTHAM, MASS.—The Board of Aldermen is considering the question of authorizing all wires in the business section of the city to be placed underground.

BARAGA, MICH.—Bids will be received by the village of Baraga at the office of James McMahan, village clerk, until Oct. 16, for construction of an electric-light plant and improvements to the water-works system as follows: 1—Construction of brick building, 42 ft. x 89 ft., with extensions. 2—A 120-hp gas producer plant, one 85-hp and one 35-hp gas engine or oil engines of same size. One 400-gal. triplex pump. 3—Electrical installation. One 50-kw generator, switchboard, etc. 4—Pole line and wiring. 5—Gravity pipe line. 6—Reinforced-concrete reservoir having a capacity of 180,000 gal. 7—Wells. Each of the above to be installed complete and to include all auxiliaries. Plans and specifications are on file at the office of the village clerk and at the offices of the Oscar Claussen Engineering Company, St. Paul, Minn., consulting engineer.

CROSBY, MINN.—It is reported that a company has been organized by H. De Groat, William P. Harrison and Grace Weiss, of Duluth, Minn., to establish a water, light and power plant. The company will be capitalized at $50,000.

DULUTH, MINN.—The City Council has directed the Duluth Street Railway Company to extend its railway from Seventy-first and Grand Avenues to New Duluth, Minn.

FARMINGTON, MINN.—A company has been organized in Farmington, to be known as the Farmington Electric Light & Power Company, for the purpose of supplying electricity in this town. The company is in the market for electrical material of all kinds. The plant is equipped with a 220-volt, three-phase system. The officers of the company are: A. H. Sprute, president; F. H. Eddy, vice-president and manager; Charles S. Lewis, secretary, and C. A. Carlson, treasurer.

MAYNARD, MINN.—Application has been made to the Council for a franchise to install an electric-light plant in Maynard.

THIEF RIVER FALLS, MINN.—It is reported that bids for the erection of an auxiliary steam plant have been laid aside until the committee has investigated oil plants. Bonds to the amount of $40,000 were recently voted for improvements to the municipal electric plant.

FORSYTH, MO.- The Ozark Power & Water Company, Chemical Building, St. Louis, Mo., is contemplating the construction of a hydro-electric plant on White River, about 2 miles from Forsyth, to cost about $550,000. Holman & Laird, of St. Louis, Mo., are consulting engineers.

MONETT, MO.—Work has commenced on the construction of the proposed municipal electric-light plant, for which bonds to the amount of $35,000 were voted in the spring of 1910. The construction of the plant has been delayed by litigation instituted by the private company now operating in Monett.

UNIONVILLE, MO.—Plans, it is reported, are being considered for the reconstruction and extension of the municipal electric-light plant and water-works system for which bonds to the amount of $10,000 have been voted. B. H. Bonfoey is Mayor.

TERRY, MONT.—The proposition to grant a ten-year franchise to E. H. Phillips to establish an electric-light plant in Terry will be submitted to a vote on Oct. 9.

GRAFTON, NEB.—The contract for construction of the proposed electric-light plant and water-works system has been awarded to the Alamo Engine & Supply Company, of Omaha, Neb., for $12,490. Elmer L. Jensen, of Harvard, Neb., is engineer.

HINSDALE, N. H.—The Selectmen of Hinsdale have entered into a contract with the Twin State Gas & Electric Company, of Brattleboro, for street lighting for a period of ten years. The contract calls for 40-cp lamps at $17 each per year and 80-cp lamps at $20 per lamp per year. The company agrees to put its line in thorough repair and to install new street fixtures. It is proposed to replace the 40-cp lamps on Main Street with lamps of 80 cp.

CHESTER, N. J.—The lighting commissioners have entered into an arrangement with the Bernards Water Company, of Bernardsville, N. J., to light the streets of the town with electricity. The service will be supplied from the Forest Hills plant.

CLAYTON, N. J.—At an election held recently the citizens voted against the proposition to issue $10,000 in bonds for the installation of a municipal electric-light plant. A bill was passed by the last Legislature giving Clayton authority to borrow $10,000 for the construction of a municipal light plant.

PATERSON, N. J.—The contract for the installation of the fire and police alarm system has been awarded to the Gamewell Fire Alarm Company for $21,750.

RED BANK, N. J.—T. F. Hylan, of the Blackall & Baldwin Company, who was engaged by the commissioners to prepare plans and specifications for the proposed municipal electric plant in Red Bank, has submitted his report to the commissioners. He estimates the cost of the plant at $35,000 and the annual cost of operating same at $8,350, including interest on the investment. At present it costs the town $9,560 per year for municipal lighting.

IOLA, N. M.—B. E. Kern, of Deming, N. M., and associates are making arrangements to install a large central electric power plant to supply electricity to operate pumps and motors for the purpose of irrigating about 32,000 acres of land in this section. The project includes the installation of producer gas generators, gas engines, electric generators, 100 pumps of 1000-gal. capacity each, 100 motors of 25-hp each and 50 miles of transmission lines. A well will be driven upon each tract of 320 acres and a pump installed. The cost of the work is estimated at $260,000.

LAS CRUCES, N. M.—The Tri-State Telephone Company has been granted a franchise to install a telephone system at Las Cruces. D. D. Clark is local representative.

BINGHAMTON, N. Y.—Mayor John J. Irving has signed the ordinance passed by the Council calling an election to vote on the proposition to issue bonds to the amount of $158,000 for the installation of a municipal electric-light plant in Binghamton.

NEWBURGH, N. Y.—The City Council has awarded a contract for fifty-three ornamental lamp standards, each to carry two globes, to the Ornamental Light Company, of New York, N. Y., at $55 each. The contract for erecting the new standards was awarded to the Central Hudson Gas & Electric Company, at $16 each.

NEW YORK, N. Y.—The contract for the installation of a conduit and electric-wiring system in the new post office building in New York, N. Y., is reported to have been awarded by the supervising architect to the Van Wagoner Construction Company, 1133 Broadway, New York, N. Y., at $55,720.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until Oct. 16 for installing electric elevators and ash hoist in the Washington Irving High School, located on Irving Place, between Sixteenth and Seventeenth Streets, Borough of Manhattan, N. Y. Blank forms, plans and specifications may be seen at the above office.

OLEAN, N. Y.—The contract for construction of underground conduits in Olean by the New York Telephone Company has been awarded to the Dunkirk Construction Company, of Dunkirk, N. Y.

PENN YAN, N. Y.—Among the improvements contemplated at Keuka College is the installation of an electric-light plant. William J. Tylee, secretary and superintendent of the Penn Yan, Keuka Park & Branchport Railway Company, has given the use of an engine and William T. Morris has contributed an engine. The plant will be installed at once.

SYRACUSE, N. Y.—Complete plans and specifications for extending

the underground service of the fire alarm telegraph system have been submitted by E. A. Fitzgerald to H. E. Hessler, commissioner of public safety. As soon as plans are approved proposals will be called for.

TONAWANDA, N. Y.—The Frontier Electric Railway Company, which was recently granted a franchise to operate an electric railway through North Tonawanda, will apply to the Board of Aldermen for a franchise to operate its proposed railway through Tonawanda. The new road will be built over a private right-of-way.

WAPPINGER FALLS, N. Y.—The Garner Print Works & Bleachery has recently remodeled and extended its electric-light system in Wappinger Falls. A twenty-four-hour service has been established, electricity being supplied for lamps and motors. Lester McKenney is electrical engineer.

CHARLOTTE, N. C.—Proposals will be received by the Board of Water Commissioners of the city of Charlotte, at the office of A. H. Hearn, clerk, until Oct. 17, as follows: For furnishing two 300-hp motors, two 5,000,000-gal. centrifugal pumps, one 3,000,000-gal. steam pump, transformers and switchboard, two boilers and setting same, laying about 9 miles of 24-in. cast-iron pipe and furnishing valves. Plans and specifications are on file at the above office and in the office of Gilbert C. White, engineer, Charlotte, N. C.

NASHVILLE, N. C.—It is reported that L. L. Davenport is interested in a project to establish an electric-light plant to supply electricity in Nashville. It is proposed to form a company to operate same.

BARBERTON, OHIO.—The Barberton Light & Power Company is reported to be contemplating extensions and improvements to its plant to meet the increasing demand for electrical service.

BEAUMONT, OHIO.—Arrangements are being made by J. J. Henry, for the erection of a large central power station at Beaumont, Ohio, with the purpose of utilizing the waste coal in the Hocking Valley for fuel to generate electricity for long-distance transmission. Surveys for the proposed plant will soon be made under the supervision of the J. G. White Company, of New York, N. Y. The cost of the plant is estimated at $1,500,000. It is proposed to supply electricity to all the mines in the Hocking Valley district and to towns and railways in that vicinity.

CLEVELAND, OHIO.—The Pennsylvania Railroad Company is reported to have been granted a permit to erect a power plant at the foot of West Fiftieth Street, to cost approximately $75,000.

DENNISON, OHIO.—The high-tension transmission line between Dennison and New Philadelphia, Ohio, has been completed. Electricity for operating the local system and the Dennison-Uhrichsville street cars will be supplied from the plant at New Philadelphia. The local plant will be converted into a substation and a motor-generator set installed for use in case of emergency.

STEUBENVILLE, OHIO.—Extensive improvements and extensions, it is stated, are to be made to the system of the Tri-State Traction & Light Company in Steubenville as soon as the improvements now under way at the East Liverpool plant are completed. The cost of the work is estimated at about $40,000.

MULDROW, OKLA.—Sealed bids will be received at the office of the town clerk, Muldrow, Okla., until Oct. 10 for construction of combined water-works system and electric-light plant, to cost approximately $33,000. Plans and specifications are on file at the office of the city clerk and the office of the Western Engineering Company, 703 American National Bank Building, Oklahoma City, Okla. E. A. Miller is city clerk.

ASHLAND, ORE.—The Siskiyou Electric Power & Light Company, of Yreka, Cal., which owns the Ashland Electric & Power Company, has been instructed by the City Council to remove its poles and wires from the streets by Oct. 15. The city claims that the company is operating without a franchise. The Siskiyou company has submitted a tentative proposition to the Council offering to settle difficulties permanently by taking over the municipal electric plant, assuming the bonded indebtedness amounting to $105,000 and other considerations, including a contract for fixing of rates for service during the period of the fifty-year franchise it asks.

HOOD RIVER, ORE.—A proposition has been submitted to the City Council by Samuel Samson offering to supply electricity for lamps and motors in Hood River at 50 per cent lower than the present charge. If the offer is accepted Mr. Samson will erect a transmission line from his plant on Wind River, near Stevenson, Wash., to Hood River.

KENO, ORE.—Plans are being considered by the Siskiyou Electric Light & Power Company for the erection of the necessary transmission system to tie its subsidiary electric-power plants with its main generating station at Keno. L. J. Ban is in charge of the work.

ONTARIO, ORE.—The Snow-Moody Development Company is planning to install an electric-pumping plant on the Snake River.

PENDLETON, ORE.—Estimates have been submitted to the City Council by the Pacific Power & Light Company and the Pacific Telephone & Telegraph Company as to the cost of placing wires underground in the business section of the city. The cost to the power company is estimated at $20,900 and that to the telephone company at $20,000.

PORTLAND, ORE.—The Oregon Electric Railway Company is planning to erect five new substations in the near future.

PORTLAND, ORE.—The Portland Railway, Light & Power Company has made application for several franchises for extensions in the east section of the city.

PORTLAND, ORE.—Plans are being prepared by the Portland Railway, Light & Power Company for extending its electric railway from Rose City Park to a point near the Columbia River.

PORTLAND, ORE.—An electric-light and power plant will be installed in the twelve-story addition to be erected to the Oregon Hotel, plans for which are being prepared by Doyle, Patterson & Beach, of Portland, architects.

SALEM, ORE.—The City Council has passed ordinances providing for the installation of ornamental lamp standards, each carrying three lamps, in the business section of the city.

THE DALLES, ORE.—Application has been made to the City Council by N. C. Evans, of Hood River, Ore., for an electric-light and power franchise at The Dalles. A reduction of 25 per cent in the present rates is offered. Mr. Evans owns a power site on the Hood River and proposes to erect a 7000-hp hydroelectric power plant with transmission lines to this place and Mosier.

PANAMA.—The date for receiving proposals for plant and materials for the hydroelectric station at Gatun as per circular No. 648 has been extended from Oct. 9 to Oct. 24. Major F. C. Boggs is general purchasing officer.

PHILADELPHIA, PA.—A proposition to convert the old Fairmount pumping station into an electric generating plant to supply electricity for lamps for Fairmount Park is under consideration by Mayor Reyburn and other city officials.

MANILA, P. I.—Sealed proposals will be received at the office of Major C. H. MacKinstry, officer in charge of defensive works, Manila, P. I., until Dec. 4, for condensers, pumps, feed-water heaters and forced draft fans. For further information apply to the above office or to the Chief of Engineers, United States Army.

DUPREE, S. D.—A franchise has been granted to T. E. Sexton to install a telephone system in Dupree.

BRISTOL, TENN.—W. J. Oliver, of Knoxville, Tenn., has completed the construction of a dam across the Wautauga River, in Carter County, for the development of 3000 hp to be transmitted to Bristol. The transmission line from the power house to Bristol has been completed by the Wautauga Power Company and the company will soon be ready to supply hydroelectric power in this city.

ALVIN, TEX.—The Alvin Water, Light & Ice Company and the Alvin Ice, Light & Power Company have been consolidated. Arrangements are being made to organize a new company to be capitalized at $40,000.

AUSTIN, TEX.—Plans have been prepared by J. C. Dumont and associates for the construction of a 15-ft. dam across the Colorado River near Austin for the purpose of securing a water supply to irrigate about 10,000 acres of land. The proposed dam will be 350 ft. long, built of reinforced concrete and will also supply power for generating electricity to be transmitted to neighboring industrial enterprises. The plant will have an output of 300 hp.

BRUNNER, TEX.—The plant of the Brunner Water & Light Company has been completed and placed in operation. The company is chartered to supply water and electricity in Brunner and surrounding territory, including Chaneyville.

CARLSBAD, TEX.—Plans which have been accepted for the new tuberculosis sanitarium at Carlsbad include a power and light plant. It is understood that bids will soon be asked for construction of same. Henry T. Phelps, of San Antonio, Tex., is architect.

COMMERCE, TEX.—The Gulf Cities Telephone Company, it is reported, is contemplating putting its cables underground in the business section of the city and installing a flashlight police-alarm system.

DENTON, TEX.—The City Council is reported to have awarded a contract to the Briggs-Weaver Company, of Dallas, Tex., for improvements to the municipal electric-light plant, to cost about $10,000. The work will include the installation of a 200-kw alternating-current generator and a 300-hp Corliss engine.

ELECTRA, TEX.—It is reported that plans are under consideration to form a company for the purpose of establishing a plant to supply electricity in Electra.

GUFFEY, TEX.—The Beaumont Ice, Light & Refrigerating Company is extending its electric transmission system to the oil field adjacent to Guffey to supply electricity to operate the pumps. The present steam pumping plant will be replaced by electric motors.

HARLINGEN, TEX.—At an election held recently the proposition to issue bonds to the amount of $22,000 for water works and electric-light plant was carried. It is understood that contract for construction of the plants will soon be let.

HEARNE, TEX.—The O'Neil Engineering Company, of Dallas, Tex., is reported to have been awarded the contract for construction of electric-light plant and water-works plant. The electric plant will have an output of 75 kw. The cost of the work is estimated to be in the neighborhood of $30,000.

MARLIN, TEX.—A franchise has been granted to J. B. Earle, of Waco, Tex., to install a telephone exchange and system in Marlin.

PORT LAVACA, TEX.—The Port Lavaca Light, Ice & Power Company is reported to be contemplating enlarging and improving its system. It is proposed to enlarge the cold-storage and refrigerating departments and install a 125-hp engine.

WACO, TEX.—The City Commissioners are reported to be contemplating the construction of a municipal electric-light plant, for which bonds to the amount of $250,000 have been voted. It is said that negotiations between the commissioners and the Waco Gas & Electric Company relative to a new lighting contract have ceased.

KAYSVILLE, UTAH.—The stockholders of the Davis County Light & Power Company have decided to increase the capital stock of the company from $50,000 to $150,000, the proceeds to be used for improvements and extensions to its system, including the erection of an auxiliary steam power plant for use during low water periods and emergencies. It is also expected that the company will extend its distributing system to supply electricity to all the towns in Davis County.

LOGAN, UTAH.—The Trustees of the Agricultural College of Utah have awarded the contract for the construction of an electric-light plant for the college to M. J. Moran, of Ogden, Utah, at $17,000. The plant will be located at the mouth of Logan Canyon and will supply electricity for the State building at Logan the surplus to be transmitted over the transmission lines of the Telluride Power Company to Salt Lake City and Ogden, to furnish electrical energy to the State University, State penitentiary and the reform school. The plant will be under the supervision of the Board of Trustees of the Agricultural College.

SALT LAKE CITY, UTAH.—The City Council, it is reported, has authorized the installation of 200 new street arc lamps.

SALT LAKE CITY, UTAH.—The Salt Lake Commercial Club is considering a proposition to illuminate South Temple and Third South Streets from Main Street to the railroad station.

ROANOKE, VA.—The Roanoke Railway & Electric Company is planning to erect a new substation at Mason's Creek on the Salem line. The station will have an output of 500 hp and will supply electricity to operate its railway between the city limits of Roanoke and Salem.

WEST POINT, VA.—The Town Council has granted the People's Light, Heat & Power Company a franchise to supply electricity for lamps and motors in West Point. John R. McRae is president of the company.

CHEHALIS, WASH.—The Board of Commissioners of Lewis County has granted the Washington-Oregon Corporation a franchise to erect a transmission line from Chehalis to Meskill, in return for which the company has agreed to supply electricity for lighting the court house, free of charge, as long as the franchise is in effect. The cost of lighting the court house is about $250 per year.

GOLDENDALE, WASH.—The Pacific Light & Power Company, which recently took over the local electric plant, has been granted a franchise by the County Commissioners to erect a transmission line from Goldendale to Centerville, a distance of 7 miles. The company is said to be preparing to make extensive improvements to the plant.

NORTH YAKIMA, WASH.—The Pacific Power & Light Company has awarded the contract for the erection of a new electric plant in North Yakima to Pinner & Griffith, of North Yakima, at a cost of $23,400. The City Council has awarded the Pacific Power & Light Company a contract to supply electricity for an ornamental street-lighting system. Cluster lamps will be installed.

SEATTLE, WASH.—The Board of Public Works has approved an ordinance providing for the installation of a central fire-alarm system, to cost approximately $45,000.

SPOKANE, WASH.—Plans have been prepared by the city of Spokane for an ornamental street-lighting system on the Monroe Street bridge.

VANCOUVER, WASH.—The Mount Hood Railway & Power Company has been granted a franchise to operate an electric railway in Vancouver for a period of fifty years. The company contemplates extensions to its railway system in Vancouver and Clarke Counties, involving an expenditure of about $1,000,000.

WALLA WALLA, WASH.—Mayor Cropp, in a message to the City Council, recommends the construction of a municipal electric-light plant.

NEW MARTINSVILLE, W. VA.—The property and franchises of the New Martinsville Electric Light, Heat & Power Company will be sold at auction on Oct. 26 by George Hook, trustee.

ASHLAND, WIS.—It is reported that preparations are being made by the Ironwood & Bessemer Railway & Light Company for the erection of a transmission line from Mellen Falls to Ashland, a distance of 27 miles.

PLYMOUTH, WIS.—It is reported that bonds to the amount of $20,000 will be issued, the proceeds to be used for rebuilding the municipal electric-light plant.

LETHBRIDGE, ALTA., CAN.—Sealed tenders will be received by G. W. Robinson, secretary and treasurer of the city of Lethbridge, until Nov. 24 for furnishing and installing the following equipment for the municipal power station extension: Section B—Boilers and accessories. Section C—Mechanical draft and economizer. Section D—Steam turbo-generator and condensing equipment. Section E—Steam-driven exciter. Section G—Substation equipment. Plans and specifications can be obtained from Arthur Reid, superintendent engineer, of Lethbridge, Alta.

VERMILION, ALTA., CAN.—Tenders will be received by C. V. Ceasar, secretary and treasurer of Vermilion, until Oct. 16, for furnishing and installing the following equipment: Section A—Steam boiler, feed pumps, heater, etc. Section B—Steam engine. Section C—Electric generator and switchgear. Plans and specifications may be obtained on application to C. V. Ceasar, secretary and treasurer, or from Bowring & Logan, engineers, 34 Victoria Street, Toronto, Ont., Can.

VICTORIA, B. C.—The British Columbia Electric Railway Company has awarded a contract to Moore & Pethick for an extension of its railway along the Saanich peninsula for a distance of 18 miles.

NIAGARA FALLS, ONT., CAN.—It is stated that the new Q. V. N. F. park boulevard, between Niagara Falls and Ft. Erie, will be lighted by electricity. It is proposed to erect ornamental lamps standards with cluster lamps 100 ft. apart on the boulevard.

NORWICH, ONT., CAN.—The by-law authorizing the town to purchase the local electric-light plant was carried at an election held Sept. 15. It is understood that electricity for operating the system will be secured from the Hydroelectric Power Commission and a twenty-four-hour service established.

TORONTO, ONT., CAN.—Tenders will be received by the chairman of Board of Control, City Hall, Toronto, Ont., Can., until Oct. 18 for furnishing overhead and pole-line materials, including No. 00 trolley wire, 300,000-circ. mil feeder wire, steel tubular poles, span wire, hangers, ears, insulators, pins, etc., plans and specifications for which may be obtained on application to the Department of Railways and Bridges, office of the city engineer, Toronto. G. R. Geary, Mayor, is chairman of board.

BUCKINGHAM, QUE., CAN.—The James Maclaren Company, of Buckingham, has awarded a contract for the construction of a dam across the Lievre River above High Falls, located 25 miles from Buckingham, to Haney, Quinlan & Robertson, of Montreal, Que. J. B. McRea is engineer in charge.

New Industrial Companies.

THE CONLAN ELECTRICAL MANUFACTURING COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $25,000. The company proposes to manufacture electric switches, plugs, receptacles, etc. The incorporators are G. A. Reading, M. E. Reading and W. H. LaForge, of New York, N. Y.

THE ELECTRIC MAIL CARRIER COMPANY, of New York, N. Y., has been incorporated with a capital stock of $20,000 for the purpose of manufacturing and dealing in mechanical appliances and devices. The incorporators are: C. E. Reid, of New York, N. Y.; W. J. Griffiths, Jr., and C. G. Rice, both of Mount Vernon, N. Y.

THE KARTZMARK SAFETY DEVICES COMPANY, of New York, N. Y., has been granted charter with a capital stock of $20,000 and proposes to do a general mechanical engineering business. The incorporators are: George B. Hinckley, 71 Windsor Avenue, Buffalo, N. Y.; Otto Kartzmark, 7901 Third Avenue, Brooklyn, N. Y., and Otto Griswold, 25 Magnolia Avenue, Jersey City, N. J.

THE KENDRICK ELECTRIC COMPANY, of Seattle, Wash., has been incorporated with a capital stock of $30,000 by R. G. and T. C. Kendrick to manufacture and deal in electrical machinery.

THE SHOCKLESS CURRENT ELECTRIC & MANUFACTURING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000. The incorporators are: C. Sulzner, G. Kuenatle and C. E. Luburg, of Philadelphia, Pa.

THE SIEMUND-WENZEL ELECTRIC WELDING COMPANY, of Washington, D. C., has filed articles of incorporation under the laws of Delaware. The company is capitalized at $100,000 and the incorporators are: W. R. Gravenor, B. L. Hackenberger and H. J. Pack, of Washington, D. C.

THE UNIVERSAL TURBINE COMPANY, of Jersey City, N. J., has filed articles of incorporation with a capital stock of $300,000. The company proposes to deal in machinery. The incorporators are: H. Stanley Todd, 80 West Fortieth Street; William Donahue, 1 Liberty Street, both of New York, N. Y., and M. Casewell Heine, 16 Osborne Terrace, Newark, N. J.

THE WEEKS REFLECTOR COMPANY, of New York, N. Y., has been incorporated by Philip Huetwohl, Schuyler M. Meyer, 71 Broadway, and Reginald Sanford, 217 William Street, New York, N. Y. The company is capitalized at $10,000 and proposes to manufacture illuminating appliances, reflectors, etc.

THE WINKLER CONSTRUCTION COMPANY, of Augusta, Maine, has filed articles of incorporation with a capital stock of $1,000,000 for the purpose of manufacturing and installing machinery, power equipment, etc., and building power houses and factories. E. M. Leavitt is president and treasurer and Lewis A. Burleigh, clerk.

New Incorporations.

PHOENIX, ARIZ.—The National Power Company of Mexico has been incorporated with a capital stock of $1,000,000. The officers are: Edward S. Field, president; Walter R. Grogan, vice-president, and Conrad Krichner, secretary and treasurer.

CALISTOGA, CAL.—The Calistoga Electric Company has been incorporated with a capital stock of $25,000 by D. R. Wedamand, C. W.

Crouch and E. M. Billings. The company proposes to purchase electricity from the Napa Valley Electric Company for distribution in Napa Valley.

CHICAGO, ILL.—Articles of incorporation have been filed for the Oak Hill Street Railway Company with a capital stock of $20,000 to construct and operate street and interurban railways. The incorporators are: Charles Pullman, I. A. Isaacson and L. S. Watts.

NORTHWOOD, N. D.—Articles of incorporation have been filed for the Northwood Mill & Light Company with a capital stock of $25,000 by David D. Hiebert, of Harvey; Otto O. Restodius, of East Grand Forks, and Otto Sangstad, of Northwood.

MANHEIM, PA.—The Manheim Suburban Electric Company has been granted a charter with a capital stock of $100,000. W. W. Griest, of Lancaster, Pa., is one of the incorporators.

Personal.

MR. THOMAS A. EDISON sailed from Europe for home on September 28.

MR. H. H. SCOTT, of Henry L. Doherty & Company, has gone abroad for a two months' recreation trip.

MR. HAROLD W. PRICE, of the electrical engineering department of the University of Toronto, Canada, has been appointed associate professor of electrical engineering.

MR. VAL. A. FYNN, consulting electrical engineer and designer for the Wagner Electric Manufacturing Company, has returned to St. Louis after spending three months in Europe.

MR. CHARLES S. WINSTON, chief engineer for the Kellogg Switchboard & Supply Company, of Chicago, has been elected president of the Alumni Association of the University of Chicago for the year 1911-1912.

MR. W. H. PAPE, who for five years has been general manager of the Pittsburgh & Butler Street Railway Company and the Butler Passenger Railway Company, has resigned his position to go into manufacturing business for himself.

PROF. HARRIS J. RYAN, of the electrical engineering department of Stanford University, California, has been granted a year's leave of absence in order to conduct some investigations in connection with the Los Angeles aqueduct.

MR. H. W. DEININGER, formerly Iowa representative of the Globe Machinery & Supply Company, has accepted the position of general manager of that company, succeeding Mr. R. W. Richardson, who goes with H. M. Byllesby & Company, Chicago.

MR. A. H. KROM, formerly employed by the Commonwealth Edison Company as commercial and illuminating engineer, has been appointed in charge of the illuminating engineering and sales of the Chicago branch of the Haskins Glass Company, of Wheeling, W. Va.

PROF. ALEXANDER D. DU BOIS, who was instructor in electrical engineering at Cornell University last year, has entered upon his duties as assistant professor at Purdue University. Prof. Du Bois, who is a native of Springfield, Ill., is a graduate of the University of Illinois.

MISS GRACE T. HADLEY, formerly associate editor of the *Electric St. Louis Magazine*, the publication of the Union Electric Light & Power Company, St. Louis, has joined the editorial staff of *Popular Electricity*, Chicago, in which she will conduct a department of interest to women readers.

MR. ERNEST P. KORST has been appointed new-business manager for the Ottumwa (Ia.) Railway & Light Company. Mr. Korst is a brother of Mr. Phillip H. Korst, general manager of the Janesville (Wis.) Electric Company, and was formerly located at Spokane, Wash., Sand Point, Idaho, and Eugene, Ore.

MR. A. M. BUCK, M.E., for two years assistant professor of electrical engineering at New Hampshire College and for the past year professor of electrical engineering at the Clarkson School of Technology, has been appointed assistant professor of railway electrical engineering at the University of Illinois. Mr. Buck is a Cornell graduate of 1904.

MR. CALVERT TOWNLEY, assistant to President E. M. Hepp, of the Westinghouse Electric & Manufacturing Company, has been placed in charge of the auxiliary Westinghouse organization to succeed Mr. George C. Smith, who resigned to devote his time to the interests of the engineering firm of James Stewart & Company, of which he is a member.

MR. JAMES P. McGRADY, treasurer of the Worcester Electric Manufacturing Company, Worcester, Mass., was married Oct. 3 to Miss Anna E. Kett, of Fairhaven, Vt., the wedding taking place at the home of the bride's mother. The bride is a daughter of the late Mr. T. H. Kett, of the Victor Slate Company, who was well known in electrical circles.

MR. T. C. MARTIN, secretary of the National Electric Light Association, encountered a feature not down on the program on the occasion of his recent address before the British Columbia Section of that association at Vancouver, B. C. He was presented with an N. E. L. A. section badge made of British Columbia gold. This gift is now one of the choicest of Secretary Martin's trophies.

MR. CHARLES C. TENNIS, president of the Tennis Company, has been elected vice-president of the Pittsburgh & Butler Street Railway Company in charge of operation. Mr. Tennis is a native of Juniata County, Pennsylvania, and has been for some years actively engaged in the construction and operation of electric-railway properties in Pennsylvania, Ohio, Indiana and Kentucky.

MR. GEORGE A. DAMON, dean of Throop Polytechnic Institute, of Pasadena, Cal., begins this year his active duties as supervisor of electrical, mechanical and civil engineering. Mr. Damon also retains his connection with the Arnold Company, which has been occupied recently in making an investigation of the transit situation in Los Angeles. Mr. Royal W. Sorensen is professor of electrical engineering at Throop Institute.

MR. W. H. TIMBIE has been appointed head of the applied science department at Wentworth Institute. Prof. Timbie is a graduate of Williams College in the scientific course and was formerly instructor at Pratt Institute, Brooklyn. He is author of a treatise on the elements of electricity. Mr. Philip Brooks, assistant to Mr. Timbie, was graduated from Pratt Institute, where he was instructor for two years subsequent to graduation.

DR. HENRY PHELPS GAGE, who has been conducting experiments relating to light phenomena at Cornell University during the past three years, has become associated with the Corning Glass Company, Corning, N. Y., to devote his time for the present to the photometry of railroad signals. Dr. Gage graduated from Cornell University with the degree of A.B. in 1908. He received the degree of M.A. in 1909, and Ph.D. in 1911.

PROF. A. L. WILLISTON, for the past twelve years director of the School of Science and Technology of Pratt Institute, Brooklyn, has resigned that position to become principal of Wentworth Institute, a new trade school in Boston. Prof. Williston is a graduate of the Massachusetts Institute of Technology and before going to Pratt Institute in 1898 was a member of the faculty of his alma mater and of Ohio State University. He will make his home in Brookline, Mass.

MR. F. H. TIDNAM, general manager of the Oklahoma City Gas & Electric Company, is abroad on an extended vacation visiting relatives in England. Before his return to the United States next month he plans to tour Germany and other Continental countries. While this is primarily a pleasure trip, Mr. Tidnam has a business mission abroad in connection with the European rights for a reinforced-concrete pole for which he is the patentee. During Mr. Tidnam's absence Mr. W. R. Molinard is acting general manager at Oklahoma City.

MR. HARRISON T. MATTHEW, who is now in Denver and who will spend some time in Colorado, Utah and the Pacific Coast States on a special mission for the *Electrical World* and the McGraw Publishing Company, made many warm friends in Chicago during his three-year sojourn in that city as Western manager for the *Electrical World*. Before leaving, Mr. Matthew was entertained by his office associates at a dinner given in his honor at the Chicago Athletic Club and was presented with a diamond-studded watchfob as a memento of a pleasant companionship.

PROF. H. H. HIGBIE has been appointed head of the electrical department at the new Wentworth Institute in Boston. Professor Higbie is a graduate in electrical engineering from Columbia University. After teaching steam and gas-engine laboratory practice at Columbia, he was instructor in the same subjects at the University of Michigan, after which he entered the electrical engineering department of that university as instructor in dynamo-electric machinery. For several years he was assistant professor of electrical engineering, in charge of the dynamo and photometric laboratories at Michigan. He has also made a specialty of electrical illumination.

MR. E. C. CARPENTER, who has been with the Indiana Union Traction Company interests for some years in various capacities, has been appointed manager of the Pittsburgh & Butler Street Railway Company and the Butler Passenger Railway Company to succeed Mr. W. H. Pape. Mr. Carpenter became connected with the system in Anderson, Ill., under Mr. Charles L. Henry twenty years ago and served under Mr. Henry during the construction of the first interurban electric railway in Indiana, between Anderson and Summitville. He has remained with the Anderson City Railway and its successor, the Indiana Union Traction Company, continuously since that time.

DR. CLARENCE A PIERCE, who has been appointed assistant professor of theoretical engineering at the Worcester Polytechnic Institute to succeed Dr. George R. Olshausen, received his B.S. degree at Wesleyan University in 1902 and his M.S. degree in 1904. For seven years he has been instructor in electrical engineering at Cornell University, where in 1908, he received the degree of Ph.D. He has specialized in electrical engineering, physics and mathematics, and has published many important articles. He is co-author with Dr. Frederick Bedell of a text-book on direct-current and alternating-current testing which is now in its second edition.

MR. ALFRED CRAVEN, who has been acting as chief engineer of the New York Public Service Commission since Sept. 23, 1910, when Mr. Henry B. Seeman resigned, has been appointed chief engineer at a salary of $15,000. Mr. Craven graduated from the United States Naval Academy, Annapolis, in 1867. He served in the navy until 1871 and then became connected with the State Geological Survey of California. After some years of private practice he entered in 1884 the service of the New York Aqueduct Commission and in 1900 became a division engineer of the old New York Board of Rapid Transit Commissioners. He succeeded Mr. George S. Rice as engineer in charge of subway construction in 1884.

GENERAL GEORGE H. HARRIES has resigned his position as vice-president of the Washington (D. C.) Railway & Electric Company and is closing up his affairs in that city to become a member of the operating staff of H. M. Byllesby & Company, Chicago. He will make his home in the latter city. General Harries has been a successful public utility operator for fifteen years. He is president of the Association of Edison Illuminating Companies, treasurer of the National Electric Light Association and second vice-president of the American Electric Railway Association. He obtained his military title during the Spanish-American war. General Harries has given much time to broad movements of civic development, serving as secretary of the Washington Board of Trade in 1898 and 1899. He will be an acquisition to the Byllesby forces.

MR. CHAUNCEY L. WILLIAMS, the recently appointed Western manager of the *Electrical World,* with headquarters in Chicago, is an advertising man of ability and experience. He is a native of Madison, Wis., and a University of Wisconsin man, class of 1894. Several of his early years were spent abroad, and after leaving college he engaged in the general book-publishing business in Chicago as a member of the firm of Way & Williams, whose enterprise more than one Western author has reason to thank. Later he became the Chicago representative of the *Engineering Review,* and three years afterward he accepted the position of Western manager for the *Architectural Record,* which position he held for ten years, resigning a short time since to join forces with the *Electrical World.* Mr. Williams is a man of force and may be described as a thorough student of the modern school of constructive advertising salesmanship. He is a member of the Psi Upsilon fraternity, the City Club, of Chicago, and the Missouri Athletic Club, of St. Louis. He is married and with his interesting family makes his home in Hubbard Woods, a North Shore suburb of Chicago.

Obituary.

MR. CHARLES J. DAVIS, forty-six years old, general foreman of the electrical department of the Baltimore & Ohio Railroad Company, died last week in Baltimore after an illness of two weeks. Mr. Davis had been in the employ of the company since 1907 as general foreman of the electrical department. Prior to that time he was in the employ of the General Electric Company. His home was in Auburn, N. Y.

MR. EVERETT COPLEY, of the New York sales office of the Westinghouse Electric & Manufacturing Company, died at his home in New York on Thursday, Sept. 27, of typhoid fever. Mr. Copley was graduated from the University of Kansas in 1906, where he won a scholarship which gained him membership in the Phi Beta Kappa Society. Upon leaving college he entered the employ of the Westinghouse company and was engaged in the work of the electrification of the New York, New Haven and Hartford Railroad. About three years ago he entered the New York sales office of the company, where his great capability and thorough knowledge of electrical work soon gained for him the admiration of his fellow-employees, and a bright future was the prediction of everyone associated with him. Mr. Copley was twenty-five years of age and was a member of the Crescent Athletic Club of Brooklyn.

Trade Publications.

MERCURY-ARC RECTIFIERS.—Bulletin No. 4871 describes the General Electric Company's mercury-arc rectifiers for battery charging and supersedes that company's previous bulletin on the subject.

CONTROL APPARATUS FOR STEEL MILLS.—Bulletin No. 4873, recently issued by the General Electric Company, illustrates and describes in considerable detail that company's control apparatus for steel mills, including automatic compensators, contractors, master controllers, rheostats, controllers, etc.

DE LAVAL STEAM TURBINE.—In a 32-page pamphlet entitled "A Steam Turbine for Driving Direct-Current Generators," the De Laval Steam Turbine Company, of Trenton, N. J., presents an extended discussion of the different types of steam turbines and their comparative merits. The booklet describes the De Laval multi-stage geared turbine, as applied to driving direct-current generators and to the direct-driving of centrifugal pumps, blowers and air compressors and for rope or belt transmission.

AIR PUMPS.—Bulletin 103, issued by the Wheeler Condenser & Engineering Company, Carteret, N. J., is devoted to the Wheeler-Edwards air pump for operation in connection with surface condensers handling both air and condensed steam. The function of the air pump and its relation to the condenser proper are first taken up, and then the construction and operation of the pump are discussed in detail and a comparison of its efficiency with other types of pumps handling air and condensate is made. The bulletin contains upward of fifty illustration, including photographs of single steam-driven, twin steam-driven, triplex motor and steam-driven pumps, twin steam-driven pump with separate hot well, combined engine-driven single air pump and centrifugal pump, combined motor-driven triplex pump and centrifugal pump, and also several charts relative to the question of air and its removal from condensers.

BUSINESS NOTES.

THE LEWIS-ROTH COMPANY has removed its office from the Real Estate Trust Building, Philadelphia, to the Denckla Building, Eleventh and Market Streets, same city.

DEMAND FOR TRANSFORMERS.—The Moloney Electric Company, of St. Louis, which opened a branch office in Windsor, Ont., not long ago, reports the receipt of a large number of orders recently.

THE SIMS MAGNETO COMPANY now occupies its large plant at Bloomfield, N. J.. the main building of which occupies four and one-half acres, and has two floors. All machinery is electrically driven. The plant is entirely for the manufacture of magnetos for automobiles.

THE CROUSE-HINDS COMPANY, of Syracuse, N. Y., had an exhibit of condulets, panelboards, switches and head-lamps at the recent convention of the Illuminating Engineering Society in Chicago. The display was visited by a number of the members of the society attending the convention and elicited favorable comment.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, of St. Louis, announces the appointment of Mr. P. L. Lewis as sales representative in Texas. Mr. Lewis, who will make his headquarters in Dallas with an office in the Scollard Building, takes the place of Mr. J. A. Gelzer, who severed his connection with the above concern several months ago.

GOVERNMENT ORDER FOR ORNAMENTAL LAMP STANDARDS AND BRACKETS.—The Flour City Ornamental Iron Works has been notified under date of Sept. 26 by James Knox Taylor, supervising architect for the United States government, that its bid for lamp standards and brackets in iron and bronze had been accepted. There were eight competitors and the award was unanimous.

TRUMP TURBINES.—The Trump Manufacturing Company, Springfield, Ohio, is working its plant until 9 p. m. owing to a congestion of orders. During the past two months orders have been received for twenty-one turbines, aggregating 22,000 hp. The sizes ranged from 23-in. to 56-in. wheels for heads ranging from 15 ft. to 480 ft. Horizontal and vertical types are about equally represented, and several special types are included.

EXCESS INDICATOR.—The Excess Indicator Company, of Boston, has closed a contract with the Connecticut River Transmission Company, through the Gardner Electric Light Company, the local distributing agent, for a general application of the excess indicator in houses in Gardner, Mass. At present about 600 residences are supplied with electrical service, and of these some 400 are paying less than $1 per month, 50 cents per month being the minimum monthly charge. With the excess indicator the company is securing a large number of new contracts on the basis of a minimum of $1 per month. In Worcester the use of the indicator is already extensive. Many flats are being wired at a flat rate of 1 cent per watt per month net, in advance. The general rate is for a six-lamp service at $1.50 per month. The Gardner service above referred to is being extended to three neighboring towns, Barre, Templeton and Belchertown, on a flat basis with excess indicator. J. G. White & Company, of New York, operating managers for several electric-lighting companies, have adopted the excess indicator in Wilmington, Del., and East Liverpool and Steubenville, Ohio, and the surrounding district. The American Gas & Electric Company, of New York, another large operating syndicate, has adopted the system in Scranton, Pa., Wheeling, W. Va., Muncie, Ind., and Rockford, Ill. Several thousand excess indicators are in use in these cities. In New England they have been in use for some time in Concord and Claremont, N. H., St. Albans and Swanton, Vt., and other smaller cities and towns.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary, Geo. S. Emery, 11 N. Royal St., Mobile, Ala. Annual convention in November, 1911.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-Treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Honorary secretary, Ralph W. Pope; acting secretary, F. L. Hutchinson. Engineering Societies Building, 29 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual convention, Atlantic City, N. J., October 9-13, 1911.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, Norman Litchfield, Interborough Rapid Transit Company, New York. Annual convention, Atlantic City, N. J., Oct. 9-13, 1911.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, Engineering Societies Building, 29 West 39th St., New York. Annual convention, Atlantic City, N. J., Oct. 9-13, 1911.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Thorpe, Little Rock, Ark.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 135 Adams St., Chicago.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary, J. Andreucetti, Chicago & Northwestern Railway, Chicago. Next annual meeting (Hotel La Salle, Chicago), November 6 to 10, 1911.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, N. T. Wilcox, Lowell, Mass.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, F. D. Morris, 323 Hagerman Building, Colorado Springs, Col.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, Harvey Robinson, 124 West 42d St., New York. Meetings, fourth Tuesday of each month.

ELECTRIC CLUB, CHICAGO. Secretary, N. F. Obright, 1500 American Trust Bldg., Chicago. Meets every Wednesday noon, 303 Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York.

ELECTRIC TRADES ASSOCIATION OF PHILADELPHIA. Secretary, J. W. Crum, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursday of each month.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1413 Grand Ave., Kansas City, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago. Annual meeting, Chicago, Nov. 2, 1911.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meeting, San Francisco, second Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, L. H. Woods, 2355 Jerome Ave., New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, Indianapolis, Ind.

INTERNAL COMBUSTION ENGINE ASSOCIATION. Secretary, Chas. Kratch, 416 W. Indiana St., Chicago. Meetings, second Friday of each month.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Next meeting at Berlin in 1913.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Dubuque, Ia.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

LOUISIANA ELECTRICAL ASSOCIATION. Secretary, W. H. Bower Spangenberg, 627 Poydras St., New Orleans, La. Meets third Monday of each month.

MAINE ELECTRICAL ASSOCIATION. Secretary, Walter S. Hyman, Waterville, Maine.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, T. C. Gordon, Little Falls, Minn.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, N. J. Cunningham, Springfield Gas & Electric Co., Springfield, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Next annual convention at Seattle, Wash., second week in June, 1912.

NATIONAL ELECTRIC LIGHT ASSOCIATION, CANADIAN SECTION. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-Treasurer, H. M. Corse, Columbus Railroad Company, Columbus, Ga.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, McComb City, Miss.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-Treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION, PENNSYLVANIA SECTION. Secretary-Treasurer, Van Dusen Rickert, Pottsville, Pa.

NATIONAL ELECTRIC INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRIC CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 343 Marquette Bldg., Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary, R. Sweetland, 141 Milk St., Boston, Mass. Next biennial meeting, March, 1913.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Joseph B. Ware, Grand Rapids, Mich.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, L. G. Marks, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, Prof. I. E. Sanborn, Ohio State University, Columbus, Ohio.

ORDER OF REJUVENATED SONS OF JOVE. Mercury (Secretary), R. M. Van Vleet, 1157 Monadnock Bldg., Chicago, Ill. Annual meeting, Denver, Col., Oct. 16-18, 1911.

PITTSBURGH ELECTRIC BOOSTER CLUB. Recording Wattmeter, O. R. Bombach, 919 Liberty Ave., Pittsburgh, Pa. Meetings, fourth Monday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, H. H. Norris, Cornell University, Ithaca, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, E. B. Moore, 39 Trinity Place, Boston, Mass. Monthly meeting, first Saturday of each month, at the Massachusetts Institute of Technology, Boston.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, D. G. Fisher, 1316 Commerce St., Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, C. G. Reel, Kingston, N. Y.

VERMONT ELECTRICAL ASSOCIATION. Secretary-Treasurer, A. B. Marsden, Manchester, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 125 Monroe St., Chicago, Ill. Next annual meeting Jan. 23-25, 1912.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WIRELESS INSTITUTE. Secretary, Alfred N. Goldsmith, College of the City of New York, New York.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, Stephenson Building, Milwaukee, Wis. Next annual meeting, Milwaukee, January, 1912.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 26, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,004,002. LAMP; F. E. Euler, Elizabeth, N. J. App. filed Nov. 4, 1910. Ball and socket connection between an incandescent bulb and its socket.

1,004,005. ELECTRIC-LIGHTING SYSTEM FOR TRAINS, ETC.; T. Ferguson, Altringham, England. App. filed Oct. 21, 1910. Combination battery and axle-driven dynamo with voltage-compensating arrangement.

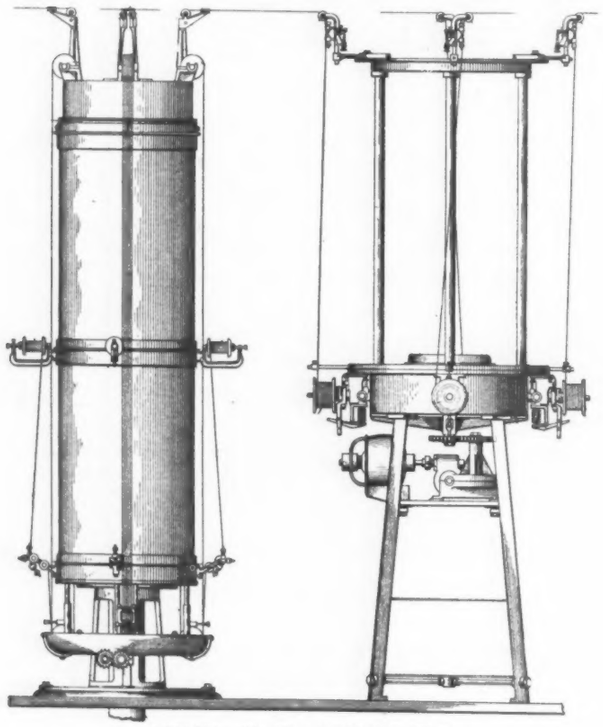
1,004,010. PUMP-CONTROLLING SWITCH; C. Gamer, Ft Worth, Tex. App. filed May 31, 1910. Float-controlled, for keeping cellars, etc., dry.

1,004,012. CURRENT-RELAYING APPARATUS; H. Gerdien, Berlin, Germany. App. filed Jan. 7, 1911. The strength of a luminous discharge is influenced by a magnetic field.

1,004,038. PRINTING TELEGRAPH; C. L. Krum, Chicago, Ill. App. filed Sept. 6, 1906. A shifting element and the printing devices are controlled by the selecting apparatus so as to increase the possible number of selections.

1,004,089. CONTROLLER FOR ELECTRICAL APPARATUS; F. L. Sessions, Columbus, Ohio. App. filed Jan. 9, 1904. For mine-locomotive motor systems, etc.

1,004,101. CABINET FOR POLE-CHANGERS AND BATTERIES; R. C. Stone, Muncie, Ind. App. filed Oct. 27, 1910. The parts are all carried by supports laterally removable from a casing.



1,004,251.—Machine for Coating Wire.

1,004,102. VOLTAGE REGULATOR; S. B. Storer, Syracuse, N. Y. App. filed Dec. 5, 1905. The secondary of a transformer is wound upon two rotatable reels, so that the number of effective turns may be varied.

1,004,106. VAPOR CONVERTER AND CONTROLLING DEVICE THEREFOR; P. H. Thomas, Montclair, N. J. App. filed Jan. 20, 1905. The container is pivoted on knife edges and tilted by a solenoid.

1,004,111. FLUID-PRESSURE BRAKE; W. V. Turner, Edgewood, Pa. App. filed Oct. 17, 1908. Automatic and electrical control for air brakes with triple valves.

1,004,119. ELECTROPLATING APPARATUS; J. Weber, Jr., and O. Cope, Toledo, Ohio. App. filed April 27, 1911. A rotatable drum for plating small metallic articles.

1,004,152. HIGH-FREQUENCY APPARATUS; W. Dubilier, Seattle, Wash. App. filed Nov. 21, 1910. A circular electrode rotates inside of an annular electrode.

1,004,165. ELECTRICAL IMMERSION HEATER; W. W. Hanscom and A. L. Langerman, San Francisco, Cal. App. filed March 20, 1909. A tubular device with the heating elements within the walls.

1,004,170. DEVICE FOR PRODUCING HIGH-FREQUENCY OSCILLATORY CURRENTS; F. Jacoviello, Parma, Italy. App. filed March 12, 1910. Gas is passed through two tubular electrodes.

1,004,230. ELECTRIC MOTOR OR GENERATOR; H. A. Balcome, Boston, Mass. App. filed Nov. 17, 1910. Artificial cooling is decreased as the speed increases.

1,004,235. LIGHTNING ARRESTER; L. S. Brach, New York. App. filed Oct. 5, 1909. A carborundum block is held between two carbon blocks under pressure.

1,004,244. SPRING-JACK SWITCH; E. B. Craft, Hackensack, N. J. App. filed Feb. 11, 1911. A plate bent to hold a plurality of jacks and their insulation.

1,004,249. ELECTROLYZING APPARATUS; J. H. Fischer, E. G. Luening and A. W. Collins, Milwaukee, Wis. App. filed March 14, 1911. For producing oxygen and hydrogen. Separate cell cases.

1,004,251. MACHINE FOR COATING WIRE; G. Gustave, Chicago, Ill. App. filed Oct. 21, 1907. Wire is passed and repassed through an annular baking furnace.

1,004,286. LIGHTNING ARRESTER; S. E. Mark, Coatesville, Ind. App. filed Oct. 21, 1909. An attachment for residence telephone lines.

1,004,290. TELEPHONE SYSTEM; C. W. McKibben, Beaumont, Tex. App. filed July 29, 1909. An impedance device is interposed in the receiver branch.

1,004,306. SWITCHBOARD PLUG; O. A. Spencer, Bloomer, Wis. App. filed Nov. 18, 1910. The plug body and tip are secured to the conductor.

1,004,314. ACTUATION OF CONTROLLERS AND THE LIKE FOR ELECTRIC MACHINERY; H. B. Van Daalen, London, Eng. App. filed May 13, 1910. A single arm actuates two or more rheostats.

1,004,316. HANGER FOR ELECTRICAL CONDUCTORS; T. Ware, Racine, Wis. App. filed Nov. 22, 1909. Has trips to connect the ends of trolley-wire sections so as to cut out a broken part.

1,004,321. COMBINATION SAFE AND VAULT PROTECTOR; E. W. West, Los Angeles, Cal. App. filed Nov. 11, 1909. Permutation means controls the signal mechanism.

1,004,369. SYRINGE; A. Ciolfi, Cincinnati, Ohio. App. filed Dec. 20, 1909. Electrodes are arranged in the circulating passage to effect decomposition or electrification.

1,004,379. ELECTRIC REGULATION; J. L. Creveling, New York. App. filed April 13, 1911. Generator voltage is automatically governed in accordance with the duty.

1,004,383. AUTOMATIC ELECTRIC SWITCH; E. W. Davis, Chicago, Ill. App. filed Oct. 22, 1910. The switch is operated by a paramagnetic solenoid core. For electric signs and flashers.

1,004,420. CONTRACTING DEVICE FOR ELECTRICAL MEASURING AND INDICATING INSTRUMENTS; E. Haagn, Hanau, Germany. App. filed Dec. 21, 1907. When the current reaches a certain point the circuit is closed and then immediately opened at another point so as to prevent arcing.

1,004,421. MEANS FOR DRIVING (RINGING) OF CHURCH BELLS AND THE LIKE; G. L. Halvardson, Stockholm, Sweden. App. filed Aug. 11, 1910. The bell is driven by a motor and the change of speed of the motor reverses the running switch.

1,004,437. ALTERNATING-CURRENT MOTOR; A. Kimble, Chicago, Ill. App. filed May 15, 1905. A hand tool, such as a drill, with a speed-controlling sleeve on the handle.

1,004,452. INDUCTION COIL; W. Meyer, Chicago, Ill. App. filed Nov. 27, 1908. A number of primary windings with interrupters are connected in multiple across a source of current and in inductive relation to a single secondary.

1,004,453. INDUCTION COILS; W. Meyer, Chicago, Ill. App. filed Nov. 27, 1908. A plurality of primary windings and interrupters are arranged in series and in inductive relation to the single secondary.

1,004,460. THERAPEUTIC LAMP; N. W. Newton, Battle Creek, Mich. App. filed May 29, 1908. An arc lamp and reflector are carried by a post vertically and revolubly mounted in a resistance coil.

1,004,469. METHOD OF CHARGING ELECTRIC FURNACES; A. L. Robinson, Niagara Falls, N. Y. App. filed Jan. 6, 1911. A layer of bituminous coal is interposed between the charge to be treated and embedding material.

1,004,479. BRUSH HOLDER FOR MOTORS OR GENERATORS; F. L. Sessions, Columbus, Ohio. App. filed June 12, 1906. The brush is pressed by a pivoted member, an adjustable member and a spring-pressed member.

1,004,518. ELECTRIC SIGNAL; D. E. Zinn, W. Winfield, Pa. App. filed Dec. 19, 1910. Mine railway signal to indicate the position of a switch.

1,004,530. PROTECTIVE DEVICE; E. E. F. Creighton, Schenectady, N. Y. App. filed Feb. 23, 1907. The flow of line current is opposed by an arc having the surface of an electrolyte as an electrolytic cathode.

1,004,531. LIGHTNING ARRESTER; E. E. F. Creighton, Schenectady, N. Y. App filed July 9, 1907. A spark gap, an electrolyte condenser and a liquid electrode arrester in series.

1,004,532. LIQUID-ELECTRODE ARRESTER; E. E. F. Creighton, Schenectady, N. Y. App. filed July 9, 1907. Mechanical details of a jar arrester.

1,004,533. ELECTROLYTIC LIGHTNING ARRESTER; E. E. F. Creighton, Schenectady, N. Y. App. filed Sept. 2, 1908. Aluminum electrodes of such size that the current density will start an arc to the electrolyte.

1,004,534. LIQUID-ELECTRODE LIGHTNING ARRESTER FOR POLYPHASE LOW-VOLTAGE CIRCUITS; E. E. F. Creighton, Schenectady, N. Y. App. filed Sept. 2, 1908. A plurality of anodes are connected to the line conductors and the liquid cathode is grounded.

1,004,535. LIGHTNING ARRESTER; E. E. F. Creighton, Schenectady, N. Y. App. filed Dec. 22, 1908. Two sets of electrodes of unequal area.

1,004,536. ELECTROLYTIC LIGHTNING ARRESTER WITH GAP AND BLOW-OUT; E. E. F. Creighton, Schenectady, N. Y. App. filed Sept. 2, 1908. An aluminum cell is shunted across an electromagnet in series with a gap.